ESSAYS ON WHEN MORE IS MORE AND LESS IS LESS: MARKETING INVESTMENTS AND PRODUCTIVITY, FIRM VALUE, AND STOCK MARKET

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ABSTRACT

Chanil Boo: Essays on When More is More and Less is Less: Marketing Investments and Productivity, Firm Value, and Stock Market
(Under the direction of William P. Putsis)

Understanding marketing accountability has been of great interest to business scholars and practitioners. To obtain deeper insights, I investigate the links between marketing investments, marketing productivity, and firm value. I specifically focus on a merger and acquisition where both budget and productivity adjust to align with marketing strategy. I use mergers as a context for the investigation of the dynamic and outcomes of marketing as a financial investment. As such, the empirical approach and managerial implication are not limited to mergers and acquisitions. The results can be extended to other circumstances, such as managerial change and any economic or structural shocks (for example, divestitures, IPO, SEO, alliances, and joint ventures) and to other strategic decisions of a firm under the circumstances in which the necessity of aggressive marketing competes with financial inflexibility.

In Essay 1, I design a test and then provide empirical evidence that enhances a discussion as to *when and how a firm's marketing investments affect its firm value*. In particular, the study focuses on two aims: 1) the relation between post-merger marketing spend and a firm's financial market performance, and 2) the path through which marketing affects stock prices. Marketing studies have emphasized that information is not a separate factor in determining and executing marketing strategy of a firm (Srinivasan and Hanssens 2009; Steenkamp and Fang 2011; Kurt and Hulland 2013). The relationship between information and firm performance is central to any

marketing strategy, and a key to this is that marketing delivers relevant information to the investors. However, what studies leave less explored is the empirical measurement and test of information asymmetry that has a decisive effect on marketing investment and firm value. To address this, I estimate the degree and effects information asymmetry has on returns to marketing investments in a merger, a natural setting where information asymmetry is most likely to exhibit the greatest effect on the relation between a firm and investors.

In Essay 2, I design a test and then provide empirical evidence that enhances a discussion as to *how marketing managers should allocate their marketing investments*, while considering a firm's marketing productivity and firm value. In particular, the study focuses on two aims: 1) the sources and effects of merger-induced changes in marketing productivity, and 2) the link between marketing and other functions of a firm in creating competitive advantage. Despite a number of attempts at modeling marketing credibility, comprehensive approaches are lacking duet to several challenges to estimating marketing productivity that researchers face (Dutta et al. 1999; Rust et al. 2004; Narasimhan et al. 2006). The dearth of research in this area is primarily because most studies have only emphasized discrete facets of marketing productivity. As such, empirical analysis, which would provide a marketing manager with holistic assessment and diagnosis and also implementable guidelines, are needed. To address this, I estimate the degree and effects changes in marketing productivity has on firm value in a merger, while providing accounts of multi-faceted aspects of marketing productivity and taking into account the effect of other functional areas such as R&D and operation.

In Essay 3, I design a test and then provide empirical evidence that enhances a discussion as to *what factors drive post-merger marketing investment decisions*. In particular, the study focuses on two aims: 1) the relation between the stock market and a firm's marketing investment,

and 2) the path through which stock prices affects marketing. Marketing studies have emphasized that past stock return and volatility are critical factors in determining marketing strategy of a firm (Mizik and Jacobson 2007; Chakravarty and Grewal 2011). However, the evidence has shown mixed results regarding whether the increase or decrease in marketing investments is a consequence of financial market performance. Prior research has been unable to provide an unambiguous explanations because there are incentives working to promote both "increase" and "decrease" investment in order to enhance firm value. To address this, I estimate the degree and effects the stock return and stock volatility at the time of a merger announcement have on the acquirers' investment patterns in marketing and R&D post-merger.

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CHAPTER 1 – INTRODUCTION

1.1 Research Question and Motivation

Do firms invest too many (or too few) resources into their marketing and R&D? Can firm-level investment be improved by re-allocating marketing and R&D spending? Given the power of marketing and R&D for firm growth and financial success, the answers to these questions are crucial. Because there are incentives working to promote both "over" and "under" investment in marketing and R&D, prior research has been unable to provide an unambiguous answer to the question: What are the financial effects when firms reconfigure their marketing and R&D spending? Extant literature attempts to answer this question by directly estimating the rate of return to marketing and R&D in models of productivity growth on measures of discretionary budgets. However, the evidence, both quantitative and qualitative, has shown mixed results regarding the benefits of discretionary expenditure (for a summary, see Rust et al. 2004). This is particularly true as it pertains to the impact of a merger or acquisition (M&A), where the optimal level of expenditure shifts and "street pressure" often permeates and influences short run behavior. Thus, the question remains; precisely how much of a change in marketing and/or R&D expenditure is due to a rational response by managers to change overall spending in response to efficiency gains post-merger and how much is myopic in nature, responding to street pressure for short-term performance? Disentangling these effects and answering these questions are the focus of this dissertation.

1.2 Research Framework

Marketing accountability is of great interest to both business scholars and practitioners. Previous studies have investigated returns to marketing in a specific context, such as contractions, equity issuing events (e.g., initial public offerings and seasoned equity offering), and product recalls (Gao et al. 2015; Kurt and Hulland 2013; Steenkamp and Fang 2011). These studies have focused on two aims: 1) whether and how "shocks" affect a firm's marketing metrics, and 2) whether and how marketing investment is associated with a firm's performance. This dissertation advances the literature by explicitly estimating a firm's productivity and by investigating its impacts on firm value. Although the current dissertation focuses on these issues within the context of a merger, the methodological approach and empirical findings may be widely applied.

Mergers and acquisitions are strategic decisions that are made to maximize a company's growth through the optimization of production and marketing operations (King et al. 2004). An entrepreneur may grow their business either by internal expansion or by external expansion. In the case of internal expansion, a firm grows gradually over time in the normal course of the business, through the development of new assets and the establishment of new lines of products. On the other hand, in external expansion, a firm acquires a running business and grows overnight through corporate combinations. These combinations are in the form of mergers or acquisitions, and have become popular under the quickly changing globalized economy, where competition is enhanced and there is a free flow of capital across countries. According to a recent report (Deloitte Center 2015), the tendency for corporations to merge has continuously accelerated. In 2015, U.S. merger deals surpassed $1 trillion, and globally, the total value reached $4 trillion. Mergers and acquisitions account for about 60 percent of the total domestic investment and nearly 80 percent of all the foreign direct investment flows.

Similarly, the mergers and acquisitions have been of considerable interest to researchers. Researchers have primarily focused on determinants and motivations, partner selection and integration process, and short- and long-term firm performance (King et al. 2004). However, results are inconclusive regarding the consequences of mergers for firm value. Although growth and innovation (2010 MSI research priorities) are often listed as critical motivations for mergers (Srinivasan and Hanssens 2009), these phenomena are not familiar to many marketing scholars, and marketing is not the first functional area to enter managers' minds when they think of mergers or acquisitions (Capron and Hulland 1999; Homburg and Bucerius 2005; Sorescu et al. 2007; Swaminathan et al. 2008). One reason for this is that there is still a lack of the research related to the role of marketing assets in the merger process. The findings of existing marketing studies looking at marketing and mergers can be summarized into two broad categories: 1) how pre-merger marketing assets create value, and 2) how post-merger integration or resource deployment affects performance. However, these studies are based on the "acquirer" or "two firm" view, and do not discuss the effect of mergers on the other parties related to the merging firms. In reality, many of the "intangible assets", such as marketing, are based on certain assumptions towards the other players in the network, such as competitors, channel partners, customers and investors of the two merging firms (Srinivasan and Hanssens 2009). In order to fully understand the role of marketing and the change in the overall landscape, a network-based approach is needed. Accordingly, I use a network-based approach to investigate the links between mergers, post-merger marketing, and firm value, while considering an acquirer's competitors in the product market as well as investors in the financial market.

1.2 Dissertation Structure and Preview

In Essay 1, I explore a contingency framework in which the expectation of investors plays a moderating role in the links between marketing investments and firm value. Specifically, I design a test and then provide empirical evidence that enhances a discussion about *how the degree of information asymmetry between an acquirer and investors affects a firm's marketing investments and firm value*. Generally, it is the investors who have less information about the firm than the firms do as the managers have special knowledge or resources that can significantly affect the firm's value. This information asymmetry can create a "lemons problem" (Akerlof 1970). Because buyers are likely to accept a price that reflects an average quality with lack of information, the low-quality lemons are more likely to enter the market than the high-quality companies. The potential for the lemons problem necessitates that firms create and implement corporate strategies that promote efficient delivery of information about firms' true value. In the present globalized world, the situation is more complex as investment is the key component that contributes to the general management of a firm and there are increasing opportunities for investors. Marketing is one of the most effective signaling mechanisms for establishing better communication between a firm and the financial market. Accordingly, I estimate the degree and the effects information asymmetry has on returns to marketing investments in a merger, a setting where information asymmetry is likely to have a large effect on the relation between a firm and investors.

I report two sets of analyses using data from several sources, including the Securities Data Corporation (SDC)'s Thompson Merger and Acquisition database, COMPUSTAT of Standard & Poor's, and Chicago Booth's Center for Research in Security Prices (CRSP) between 1990 and 2010. In order to quantify the effect and intricacy among mergers, firms, and investors,

I employ a dynamic panel General Method of Moments (GMM) approach (Arellano and Bover 1995; Blundell and Bond 1998), which allows for the modeling of the dynamic endogeneity. An initial examination of the data shows that, on average, mergers lead to acquirers' significant disinvestment in their marketing in the years following a merger. However, I also find that stock returns are greater for acquirers that invest more than their competitors do following the merger. Additionally, I find that the effects of post-merger marketing investments are contingent on the degree of information asymmetry. The results show that the positive impact of marketing on firm value is stronger and slowly decreases when the degree of information is higher compared to when the degree of information is lower.

In Essay 2, I examine how a firm, faced with the businesses restructuring phase, can strategically manage a portfolio of investments. Specifically, I design a test and then provide empirical evidence that enhances the discussion of *how changes in marketing investments and productivity through a merger affect firm value*. In theory, the merger transactions represent a wide range of unique business optimization opportunities in the production capabilities, organizational structures, and financial indicators Hitt et al. (1990, 1991). Mergers create an increase in relative efficiency, which can later translate into more profit and a sustainable competitive advantage. That is to say, a merger is successful when the companies that enter into a merger achieve better economies of scale, better use of resources, and a more effective market presence. However, enhancing production and marketing operations of the merged firm is the process fraught with difficulty because, contrary to other investment projects, mergers typically require a large amount of financial and managerial resources. Thus, the slower improvements are expected to occur (Agrawal et al. 1992). In fact, acquirers oftentimes encounter a reduction in productivity immediately following a merger despite huge investments in it, because there are

more questions than answers (Hitt et al. 1990, 1991). To address this, I estimate the degree and effects changes in marketing productivity have on the link between marketing investments and firm value in a merger, while providing accounts of multi-faceted aspects of firm productivity.

I use a sample that consists of 153 public U.S. acquirers in chemical and rubber, electronic equipment, and automotive industry. These specific industries were chosen because they are characterized by intensive use of marketing assets as well as other functional assets. I utilize the Data Envelopment Analysis (DEA) to measure marketing productivity (Banker et al. 1984; Charnes et al. 1978). This method allows for the identification of a set of action priorities for marketing managers and quantification of the gains of implementing such strategies. An initial examination of the data shows that mergers lead to acquirers' significant disinvestment in their marketing relative to a firm's rivals post-merger. However, empirical results show that increases in marketing are associated with increases in sales post-merger. Furthermore, I find a negative association between the marketing productivity increase and firm value. This juxtaposition could lead to difficult decisions for the marketing manager. Superior marketing investment is more likely to lower the level of marketing productivity, but this low productivity tends to achieve higher stock prices. I provide the underlying theoretical rationale for the negative association between productivity and firm value as well as an understanding of the conditions under which aggressive marketing investments lead to a win-win outcome for acquirers.

In Essay 3, I investigate the two-way information flows between acquiring firm managers and investors in the stock market. Specifically, I design a test and then provide empirical evidence that enhances the discussion of *whether and how stock return and stock volatility at the time of a merger drive post-merger marketing investment decisions*. In Essay 1 and 2, I find the

evidence of the effects marketing investment and productivity have on the acquirer's financial firm value. In Essay3, I find the evidence of the effects stock market has on the acquirer's marketing and R&D investment post-merger. The underlying rationale is that the stock return and volatility are useful sources of information (Hayek 1945). Because one of the fundamental roles of the stock market is to produce and aggregate of information, firms extract information from the stock fluctuation and consider it when making corporate investment decisions. The hypothesis implies that the stock market possesses information that is new to firms although managers are generally better-informed than investors about the fundamental and prospects of a firm (Luo 2005; Chen et al. 2007). This information is more likely to be related to the weakness of the merger plan the acquirer has overlooked, such as the potential competition following a post-merger integration. To address this, I estimate the degree and effects the stock return and stock volatility at the time of a merger announcement have on the mangers' investment patterns in marketing and R&D post-merger.

In order to comprehend the post-merger investment decisions, I categorize acquirers into four groups based on the pattern of marketing and R&D investments. Firms are grouped depending on whether they spend more or less than the industry average of marketing and R&D investments. I find that both merger announcement return and its volatility predict an acquirer's post-merger investment patterns. Acquirers extract information from the stock market reaction and consider it when making corporate investment decisions. By using a probit regression, I show that a negative reaction to a merger announcement leads to a superior investment in marketing of the acquirer relative to rivals and inferior investment in R&D post-merger. In addition, the results show that the relation varies with the volatility of merger announcement return, suggesting that firms have a stronger incentive to use information contained in the stock

fluctuation as the degree of information is higher. The results are consistent with the contingent role of information asymmetry found in the Essay 1 and 2.

Through these three studies, I provide an overview of the links between marketing investments, marketing productivity, and firm value. My theoretical and empirical analyses inform specific assessment and diagnosis techniques and implementable guidelines that marketing managers may use in practice, which I discuss further in subsequent chapters. Collectively, the findings from this dissertation contribute new knowledge to the field of marketing, are applicable to both researchers and practitioners, and identify promising directions for further research on mergers.

CHAPTER 2 – ESSAY 1: POST-MERGER RETURNS TO MARKETING INVESTMENTS

2.1 Introduction

The purpose of the current study is to design a test and then to provide empirical evidence that enhances a discussion as to *when and how a firm's marketing investments affect its performance in the financial market*. Recent literature has sought the performance implication of the marketing assets (for a summary, see Srinivasan and Hanssens 2009). Furthermore, studies have emphasized that information is not a separate factor in determining and executing marketing strategy of a firm. The relationship between information and firm performance is central to any marketing strategy and, in particular, to the context addressed here. A key to this is a firm's marketing actions, which serve as the fundamental path through which information is delivered to the markets. In the original seminal piece on the signaling aspect of marketing, Nelson (1970) argued that the mere fact that a firm is advertising more than competition suggests that it is of superior quality. Spence (1974) is the classic paper on the process of signaling in the economics literature. However, what previous studies leave less explored is the empirical measurement and test of information asymmetry that has a decisive effect on marketing investment and firm performance. To study this question, I estimate the degree and effects information asymmetry has on returns to marketing in a merger, a natural setting where information asymmetry is most likely to exhibit the greatest effect on marketing managers and investors.

Mergers and acquisitions continue to be popular vehicles for firm survival and growth (Barney 1991; Wernerfelt 1984). The resource-based view (RBV) considers mergers as strategic corporate investments taken in order to meet customer needs by integrating assets and capabilities that exist inside and outside the firm's boundaries. The post-merger years are eminently unique; mergers often significantly change the outlook of a firm and its industry, which increases the degree of information asymmetry for both the acquirer and investors. Therefore, I contend that examining the effect of marketing and information asymmetry in the post-merger period is particularly important and relevant relative to other contexts (e.g., contractions or equity offerings). Unlike other contexts, a merger transaction requires a considerable amount of managerial and financial resources that otherwise could support marketing. As a result, acquirers may face a temporary competitive disadvantage in terms of marketing investment because mergers expose acquirers to a significantly greater debt-to-equity ratio. Often the popular and business press suggests post-merger integration is the focus of post-merger activity and thereby recommends spending less on advertising. However, I argue that increasing marketing investment can enhance firm value by delivering critical information about an acquirer's current and future operations. Moreover, I contend that the degree of information asymmetry is a moderating variable that determines the direction and efficacy of marketing adjustments. Accordingly, I design a test to answer following questions: 1) Should acquirers increase or decrease marketing investments throughout a merger to enhance firm value? 2) What factors should acquirers consider when determining their marketing investment? The findings provide useful insights for acquiring-firm managers to allocate resources in marketing.

I report two sets of analyses using data from several sources, including the Securities Data Corporation (SDC)'s Thompson Merger and Acquisition database, COMPUSTAT of

Standard & Poor's, and Chicago Booth's Center for Research in Security Prices (CRSP) between 1990 and 2010. An initial examination of the data shows that, on average, mergers lead to acquirers' significant disinvestment in their marketing in the years following a merger, which seems to directly reflect the recommendations of the business press. However, I also find that, in fact, stock returns are greater for acquirers that invest more than their competitors do following the merger. The results suggest that, in this case, the greater marketing spend reveals managers' private information about their firms' business prospects and alleviates concerns stemming from the merger, thereby contributing positively to firm value. Besides the main effect, I find that the effects of post-merger marketing investments are contingent on the degree of information asymmetry. The results show that the positive impact of marketing on firm value is stronger and more slowly decreases when the degree of information is higher than when the degree of information is lower. In order to quantify the effect and intricacy among mergers, firms, and investors, I employ a dynamic panel General Method of Moments (GMM) approach (Arellano and Bover 1995; Blundell and Bond 1998), which allows for the modeling of the dynamic endogeneity. Further, I use a unique benchmark to make counterfactual comparisons.

I structure the rest of the paper as follows: I begin by presenting the related literature and theoretical background, from which I derive the hypotheses. Next, I describe the data sources and operationalization of measures, followed by the research method employed. Finally, I conclude by discussing the results, suggesting implications, and summarizing limitations.

2.2 Related Literature and Contribution

This study makes contributions to four related research streams, as Table 1 summarizes.

The Impact of Mergers on Firm Value

The literature has long been intrigued with understanding the magnitude of abnormal returns to acquiring firms and the factors affecting those returns (Jensen and Ruback 1983; Agrawal et al. 1992; Fuller et al. 2002). Agrawal et al. (1992), using an exhaustive sample of mergers, find that stockholders of bidding firms suffer a significant loss over the five-year period. Andrade et al. (2001) summarize a large body of evidence spanning four decades and report that announcement return to bidders is generally zero or slightly negative. Loughran and Vijh (1997) find significantly positive excess returns over the period of 1970–1989 but only when firms complete cash-tender offers. Rau and Vermaelen (1998) report that the poor performance of low book-to-market "glamour" causes the long-term underperformance of acquiring. Shleifer and Vishny (2003) argue for the influence of managerial hubris and overvaluation as explanations. Other factors investigated include merger type, relative size, strategic orientation, and both firms' structures (Loughran and Vijh 1997; Fuller et al. 2002; Moeller et al. 2004; Haleblian et al. 2012). This study contributes to this literature by identifying a marketing strategy that ultimately can improve an acquirer's short- and long-term stock returns.

The Impact of Mergers on Marketing Metrics

Research addressing marketing metrics in mergers mainly finds the decreased activity in R&D and innovation activity in the post-merger period. Hitt et al. (1990, 1991) suggest that an acquirer's lower commitment to innovation post-merger is anticipated, and as a result, acquisitions lead to lower *R&D investments*. Seru (2014) reports that diversifying mergers produce both a small number of *patents* and less-novel innovations compared to failed mergers. With respect to the factors that are associated with post-merger marketing efficacy, studies report that similarity of *knowledge base* has a non-linear impact on subsequent innovation performance.

Ahuja and Katila (2001) argue that the size of *acquired knowledge* enhances innovation output, while Prabhu et al. (2005) contend that high depth and breadth of *knowledge base* produce more innovations. Finally, Bena and Li (2014) show that firms with *prior technological linkages* between two merging entities produce more patents post-merger. This study contributes to this literature by examining a different marketing metric, *advertising investments* in a merger, and its subsequent impact on the acquirer's firm value.

Marketing Assets to Enhance Firm Value in a Merger

In contrast to finance literature, considerable marketing research has investigated the effects of marketing assets on the merger performance. Early research using a survey methodology examined the post-merger integration of marketing assets such as *brand, sales forces,* and *general marketing expertise,* in horizontal acquisitions (Capron and Hulland 1999; Homburg and Bucerius 2005). Sorescu et al. (2007) argue that the high product capital, which is measured as a pre-merger *sales force counts* and *R&D investments,* allows acquirers to better select targets with greater potential and to better deploy this potential. Swaminathan et al. (2008) explore how pre-merger *resource configurations* between advertising and R&D facilitates value creation. Moreover, the stock market exhibits positive reactions to acquisitions of a *brand* with higher price/quality positioning or greater portfolio diversity (Bahadir et al. 2008; Wiles et al. 2012). This study contributes to the literature by proposing and demonstrating a different perspective that marketing can determine an acquirer's long-term firm value by reducing *information asymmetry* between the firm and investors. I compare pre- and post-merger marketing investments, the degree of information asymmetry, and firm value, rather than focusing on either pre- or post-merger years.

Table 1
Related Literature and the Incremental Contributions of the Study

Key Issue and Main Finding	Publications	Incremental Contribution
The Impact of Mergers on Firm Value		
Key issue: Whether and how mergers improve a firm's long-term stock returns as well as announcement returns *Main finding:* An acquirer, on average, suffers a significant loss post-merger. This finding is consistent across different industries and time periods.	Agrawal, Jaffe, and Mandelker (1992) Loughran and Vijh (1997) Rau and Vermaelen (1998) Fuller, Netter, and Stegemoller (2002) Shleifer and Vishny (2003) Moeller, Schlingemann, and Stulz (2004)	This study contributes to this literature by identifying a marketing strategy that ultimately can improve an acquirer's short- and long-term stock returns by delivering information.
The Impact of Mergers on Marketing Metrics		
Key issue: Whether and how mergers affect a firm's marketing metrics such as R&D (innovation) *Main finding:* Acquisitions, on average, lead to lower investments in R&D. However, the negative impacts may be affected by several factors, including merger type, prior knowledge bases, and relatedness of a merger.	Hitt, Hoskisson, and Ireland (1990) Hitt, Hoskisson, Ireland, and Harrison (1991) Ahuja and Katila (2001) Prabhu, Chandy, and Ellis (2005) Seru (2014) Bena and Li (2014)	This study examines a different marketing metric, advertising investments in a merger, and its subsequent impact on the acquirer's firm value.
Marketing Assets to Enhance Firm Value in a Merger		
Key issue: The effect of an acquirer's pre- and post-merger marketing assets on the merger performance *Main finding:* Several pre-merger marketing assets (such as brands, sales forces, and R&D) and their post-merger integration can contribute positively or negatively to firm value.	Capron and Hulland (1999) Homburg and Bucerius (2005) Sorescu, Chandy, and Prabhu (2007) Bahadir, Bharadwaj, and Srivastava (2008) Swaminathan, Murshed, and Hulland (2008) Wiles, Morgan, and Rego (2012)	This study proposes and demonstrates a different perspective that compares pre- and post-merger periods and can determine an acquirer's long-term firm value, rather than focusing on either pre- or post-merger.

Marketing as a Moderator in the Marketing-Finance Interface		
Key issue: Whether and how advertising may moderate firm performances in several external shocks *Main finding:* A firm's advertising affects performances in specific events, including movie releases, third-party reviews, contractions, IPOs and SEOs, firm news, and product recalls.	Joshi and Hanssens (2009) Steenkamp and Fang (2011) Chen, Liu, and Zhang (2012) Kurt and Hulland (2013) Xiong and Bharadwaj (2014) Gao, Xie, Wang, and Wilbur (2015)	This study contributes to this literature by showing the moderating role of marketing in a different event: mergers and acquisitions. This study propose that advertising can be used as a strategic variable to reduce information asymmetry in the post-merger period.

Marketing as a Moderator in the Marketing-Finance Interface

Recently, marketing research has paid increasing attention to the impacts of marketing strategies on performances (Srinivasan and Hanssens 2009). As a result, past studies have investigated the moderating role of advertising in several external *shocks*. The main thesis is that investors would look to firms' advertising activities for a signal to reduce the degree of asymmetry of information (Spence 1974; Nelson 1974). However, findings on the signaling role of advertising are mixed, depending on a firm's *financial condition*. Specifically, Steenkamp and Fang (2011) report that increasing advertising has significantly *positive* effects during *contractions*. In contrast, Kurt and Hulland (2013) argue that investors may view an increasing in advertising *negatively* when *equity issuing* firms have weaker financial flexibility than their industry peers. This study contributes to this literature by presenting evidence of the *positive* signaling role of advertising in a *merger and acquisition*. I propose that marketing can be used as a strategic variable to reduce the degree of information asymmetry between the firm and investors, despite the financial disadvantage in the post-merger period.

2.3 Conceptual Framework and Hypotheses

Post-Merger Marketing Investments

A merger causes higher levels of leverage for an acquirer. The strained financial resources lead to a situation in which firms must limit their investment or reduce the quality of their products. Research has shown highly leveraged firms to be reluctant to make major advertising investments due to the intangible and nontransferable nature of marketing assets (Table 2). Even if acquirers are willing to invest more in marketing, the merger simply would be a strategic opportunity for relatively affluent rivals on the other side of the market. For instance, Telser (1996) describes how deep-pocketed firms may drive their financially weak rivals out of

the market by adopting predatory strategies, such as advertising wars. By doing so, the competitors would seek not only to communicate the value of their own growth opportunities but also to strategically negate the effect of the acquirer's marketing strategies in order to take advantage of similar opportunities that the acquirer would have cultivated. Acquirers, acknowledging the possibility of being confronted with the fierce reactions by their competitors, may not aggressively increase their marketing investments post-merger because the increased leverage would limit a firm's ability to respond in a timely manner. Accordingly, I argue that the downward direction of marketing adjustments to be observed in a year following a merger announcement, when compared to the years preceding the merger announcement. Hence, I hypothesize the following:

H1: On average, acquirers tend to decrease their marketing investments in a year following a merger announcement, compared to the years preceding the merger announcement.

Table 2
Research on the Effects of Limited Financial Resources on Marketing Strategy and Firm Performance

Authors	Study Context	Findings
Chevalier (1995)	Leveraged buyouts	Highly leveraged supermarkets compete less aggressively
Kovenock and Phillips (1995)	Leveraged buyouts	Highly leveraged firms are less likely to make major investments
Zingales (1998)	Deregulations	Highly leveraged trucking firms are less likely to survive in price wars
Hanka (1998)	All industries except financial and utilities firms	More leveraged firms tend to hire more part-time employees and pay lower wages
Khanna and Tice (2000)	Walmart's Entry	Firms with greater leverage decrease investments in resisting Walmart's entry
Peyer and Shivdasani (2001)	All industries except financial firms	Leverage motives firms to focus on short-term cash flows, which decreases long-term firm value
Grullon, Kanatas, and Kumar (2006)	New funding raised	More leveraged firms tend to invest less in advertising
Gielens, Van De Gucht, Steenkamp, and Dekimpe (2008)	Walmart's Entry	European retailers with higher leverage perform more poorly as a result of disinvestments
Kurt and Hulland (2013)	IPO and SEO firms	Financial flexibility moderates the positive impact of marketing on firm value
Phillips and Sertsios (2013)	Airlines firms	Leveraged firms increase prices and decrease product quality for short-term revenues
Malshe and Agarwal (2015)	All industries except financial firms	Leverage reduces customer satisfaction and negatively moderates its positive impacts on firm value

Positive Signaling Effects of Marketing Investments

Recent research explores the signaling role of marketing investment contributes in various economic shock contexts, including movie releases, contractions, and product recalls (Table 1). However, results are indecisive. For example, Luo (2008) investigates the relation between marketing spending and initial public offering (IPO) performance. The results uncover that the benefits of pre-IPO marketing spending are positive and not trivial. An issuer's marketing helps reduce underpricing and boost trading volume in the stock market. On the other hand, Mizik and Jacobson (2007) suggest that cutting marketing investment leads to a higher stock price in the short-term in the context of equity offering. However, the authors argue that the stocks are temporarily overestimated in that the misevaluation corrects adequately in the long run, suggesting the myopic behavior such as cutting marketing does not have a significant impact in the long term.

While these studies document the effectiveness of marketing in coping with firm-level economic changes, relatively little is known about the opposite: how firms' marketing investment adjusts to deal with the microeconomic changes and, as a result, how firm performance improves correspondingly. One notable exception is Kurt and Hulland (2013), who find that adopting an aggressive investment is the preponderant marketing strategy of equity-issuing firms. The authors argue that increased marketing can enable managers to communicate to investors about their firms' future prospects and therefore and aggressive marketing immediately enhances shareholder value. Of particular importance for this study is an intuition behind their marketing measure. The authors account for economy- and industry-wide factors in their analysis by estimating industry-year specific betas. This determines whether an equity-issuing firm invests on marketing beyond the industry forecasts. Similarly, Steenkamp and Fang

(2011) highlight the use of marketing investment measures relative to firms' competitors. They argue that theorizing based on the relative metrics is important not only because it reflects competition firms are facing but also because it is useful in investigating how firms react to changing economic conditions. Hence, I hypothesize the following:

H2: Investing more in marketing relative to its rivals in a year following a merger announcement is positively associated with an acquirer's firm value.

The Degree of Information Asymmetry and Marketing investments

A merger creates uncertainty and intensifies the information asymmetry between acquirers and investors, which may ultimately lead to lower firm value (Bartov and Bodnar 1996). Information asymmetry raises transaction costs and reduces expected liquidity in the stock market. I argue that marketing can alleviate these consequences by reducing the degree of information asymmetry between the firm and investor. In most cases, acquirers have private information not only about the quality of firms' products but also about the true financial value of firms' post-merger growth opportunities (Chemmanur and Yan 2009). In general, information asymmetry can be reduced by three mechanisms: 1) carrying legally binding forces such as contractions, 2) monitoring by outside agents, and 3) signaling (Nelson 1974; Spence 1974). Between firms and financial market agents, marketing, among various instruments, is a credible signal because investors interpret the increased investments as a manager's effort to reduce information asymmetry (Srinivasan and Hanssens 2009). Such a proactive adjustment in marketing is only economically optimal when returns to post-merger investments are expected to be positive. If the benefit of marketing is low a firm would not be able to recover the incurred costs. Hence, the decision of whether or not to increase marketing is strongly influenced by the

sign and the magnitude of the expected strategic profit, which are likely to be positive and greater when the degree of information asymmetry is higher.

The premise of the prediction is that, in the post-merger period, acquirers have incentives to reduce the degree of information asymmetry in order to maximize firm value. In fact, when increasing marketing investments, the managerial desire for a reduction of information asymmetry and thereby a maximization of firm value should outweigh other factors, including a firm's limited financial resources and market position post-merger. Hence, I argue that the degree of information asymmetry is an important conditioning variable to consider when examining the positive impacts of marketing investment on firm value. The higher the degree of information asymmetry, the more positive impacts of marketing investments is expected. High information asymmetry increases uncertainty in return on investment and therefore enhances potential incentives of both managers and investors to reduce the level of information asymmetry. To the extent that firms are able to convey information about their true value and future cash flow, the reduced information asymmetry manifests in stock prices. The positive reaction in the financial market to managers' effort on reducing the uncertainty is more likely to be apparent in the samples of acquirers with greater information asymmetry. Hence, I hypothesize the following:

H3: The positive impact of an acquirer's marketing investments in a year following a merger on firm value is moderated by the degree of information asymmetry.

2.4 Data and Measures

Sample

I collect the full sample from the Securities Data Corporation (SDC) Thompson Merger and Acquisition database between 1990 and 2010. In addition, I use the COMPUSTAT of

Standard & Poor's to collect firms' annual financial/accounting information, including marketing investment, sales revenue, and several control variables. I use the Chicago Booth's Center for Research in Security Prices (CRSP) to collect stock market–related data to estimate short- and long-term stock return. The data treatment and merging procedure closely parallel those in the prior literature (Sorescu et al. 2007; Swaminathan et al. 2008).[1] This merging process using the SDC, COMPUSTAT, and CRSP database leads to a pooled cross-sectional time series panel with a total of 2,855 observations.

I also construct control samples to compare the effects and causal relation between marketing investments, information asymmetry, and firm performance. I use two different groups of firms as controls for the empirical analysis. The first group comprises the firms that have no plan to merge, and the second group comprises the firms that had plans to merge but did not complete the merger.[2] First, I match each M&A firm with a firm that is not involved in a merger on the basis of sales, total asset, and industry. The matched firms are carefully selected with in the same two-digit SIC industry codes when the firm has the closest sales and total asset to the M&A firm's sales and total asset in year of a merger. *The matched sample* comprises 2,855 observations. The second control sample is the withdrawn mergers to address the counterfactual scenario of how an acquirer would have invested in marketing and performed in

[1] Prior literature (Croci and Petmezas 2009) finds that, for companies that engage in a series of acquisitions, merger announcement returns are not independent. Therefore, following Prabhu et al. (2005), I retain only the biggest transaction in terms of deal value to eliminate the confounding effects of sequential mergers. The final sample consists of mergers across all industries to preserve reliable and generalizable results. However, I test whether the effect is unique in the financial sector (SIC6000-6999). The result is not sensitive to the inclusion of the financial sector.

[2] Matching based on the observable variable is one of the popular strategies that can be used in this situation. The use of an unsuccessful mergers sample can be considered as more sophisticated and hypothetical matching sample approach. I report the results using a dynamic panel GMM model to account for heterogeneity and endogeneity for all samples. As a robustness check, I perform a difference-in-difference approach as well. The main results are replicable in a set of difference-in-difference analyses with two distinctive control samples.

the absence of a merger.[3] The use of the withdrawn sample as a control strengthens the investigation, as the merger decision is made endogenously and strategically. As a result, the acquirer is likely to substantially differ from an average or randomly chosen matched firm, both at the time of a merger and in future periods. To keep every aspect of the compiling of the completed and withdrawn samples consistent, I use similar steps to compile the latter, except that I only retain observations with the deal status of "Withdrawn" in the SDC database. Next, I screen out any merger attempts that are withdrawn due to reasons directly related to marketing strategy of two merging firms.[4] I categorize several cancellation reasons mainly based on the deal synopses in the SDC M&A database and manual search in LexisNexis and Factiva to supplement. *The withdrawn sample* comprises 589 mergers. I present, in Table 3, the descriptive statistics of selected variables for the completed, matched, and withdrawn samples.

Measures

I focus on both short- and long-term financial market performance. First, I estimate annual stock return by compounding the monthly stock returns for a given fiscal year. *Short-term performance* uses 12 consecutive monthly stock returns starting from the January after a merger is announced. *Long-term performance* uses 24 (2-year) consecutive monthly stock returns. To control for the value risk (Fama and French 1993), I use the risk-adjusted abnormal stock return.[5]

[3] Not all pursued acquisitions are ultimately completed due to several reasons such as regulatory intervention, competing offer, or disagreement between management and board. Similar empirical design has been used in a different context in finance literature to avoid the potential endogeneity problem (Savor and Lu 2009, Seru 2014).

[4] This allows for the use of the withdrawn sample as a strong control. In order to keep out various endogenous reasons for the merger withdrawal, I also test an even smaller sample of merger attempts that are withdrawn due to regulatory objections only (i.e., anti-trust issues). The results remain unchanged.

[5] However, the overall findings remain unchanged by the use of size-adjusted or equally weighted market portfolio (Mizik and Jacobson 2007; Mizik 2010).

Table 3
Descriptive Statistics of Financial Variables for the Completed Sample and Two Control Samples

		Completed Sample	Matched Sample	Withdrawn Sample
Total Assets	Mean	10,591	10,692	10,237
	Median	801	874	653
	Std.	78,498	78,264	88,003
Book-to-Market Value	Mean	0.46	0.48	0.49
	Median	0.38	0.35	0.37
	Std.	0.58	0.63	0.83
Marketing Intensity	Mean	0.01	0.01	0.01
	Median	0.00	0.00	0.00
	Std.	0.03	0.03	0.03
Liquidity	Mean	0.25	0.23	0.24
	Median	0.22	0.21	0.23
	Std.	0.21	0.21	0.22
Sales Growth	Mean	1.35	1.23	1.68
	Median	1.16	1.56	1.08
	Std.	3.58	4.76	10.66

Note: Total Assets is reported in dollars. Book-to-Market Value is the ratio between book value of common stock at the year of a merger and the stock price multiplied by the number of shares outstanding at the year of a merger. Marketing Intensity is advertising expenditure divided by total asset at the year of a merger. Liquidity is calculated by dividing the sum of debt in current liabilities and long-term debt by total asset at the year of a merger. Sales Growth is sales at the year of a merger scaled by lagged sales.

I construct *marketing investment* as a firm's advertising expenditure scaled by the total assets in the same year for several reasons. First, given the interest in marketing as a source of signals, advertising expenditure will be more appropriate and precise because advertising investment is highly correlated with overall marketing budget. Several studies in related literature use a share of SG&A expenditure (Mizik and Jacobson 2003; Swaminathan et al. 2008; Kurt and Hulland 2013). However, this item generally includes various forms of other expenses that are unrelated to marketing activity. Second, the primary interest lies in determining the

effect of marketing that is not associated with integration tasks. The advertising expenditure item excludes any financial value of marketing resource used for the post-merger integration.[6]

Table 4
Measurements of Information Asymmetry

Authors	Measures of Information Asymmetry	Study Context
Dierkens (1991)	Standard deviation of the market-adjusted, three-day abnormal return at the announcement, the residual volatility of the equity of the firm, the number of public announcements published, volume of trading	Equity issues
Bartov and Bodnar (1996)	Bid-ask spread, volume of trade	General
Krishnaswami and Subramaniam (1999)	Forecast error, standard deviation of forecasts, normalized forecast error, volatility in abnormal returns around earnings announcements, residual volatility in daily stock returns	Spin-offs
Frankel and Li (2004)	Profitability, intensity of insider trades	General
Chae (2005)	Company size, number of analysts, bid-ask spread, industry dummies	Scheduled and unscheduled information-revealing announcement
Moeller, Schlingemann, and Stulz (2007)	Standard deviation of the earnings announcement, abnormal return, the firm's idiosyncratic volatility	Acquisitions
Duartea, Han, Harforda, and Young (2008)	PIN, institutional ownership percentages, whether firms is covered by analysts, number of news reports	Regulation fair disclosure
Officer, Poulsen, and Stegemoller (2009)	R&D intensity, idiosyncratic return volatility	Acquisitions
Armstrong, Core, Taylor, and Verrecchia (2011)	Bid-ask spread, R&D, scaled accruals quality, analyst coverage	General

[6] Reporting marketing investment in financial statement is not compulsory. Thus, firms may use their discretion in the disclosure of information. To account for the possibility of this motive, advertising data from TNS is used in a separate analysis. The overall findings remain unchanged.

I follow the finance literature (Dierkens 1991) and use two different proxies to measure the information asymmetry (IA). The first measure focuses on the behavior of the financial market at the merger announcement. This *IA_anno* variable is measured as the standard deviation of the market-adjusted, three-day (-1, +1) abnormal returns around the merger announcement. The CRSP value-weighted index is used as a proxy for the market portfolio. A volatile reaction in the financial market at the merger announcement suggests that the degree of information asymmetry is higher for the merger. The second measure focuses on the firm's private information that is not yet shared with the financial market. This *IA_resi* variable is measures as the standard deviation of the market-adjusted daily stock price abnormal return in the year. This residual volatility captures the degree of information between the firm and investors that remains after removing the uncertainty that is common to the managers and financial market. A higher dispersion in the residual suggests that the degree of information asymmetry is higher for the merger.[7]

2.5 Empirical Analysis and Results

Mergers and Information Asymmetry

In this study, the merger and acquisition is implicitly assumed to increase the degree of information asymmetry at the time of a merger announcement and in future periods. In the following, I test this in two ways. First, I compare the levels of information asymmetry of the completed sample with those of both control samples at the merger announcement. If the announcements of a merger are subject to greater information asymmetry issues, one should

[7] To obtain the comparable announcement returns and measure of information asymmetry for the matched sample, I use the volatility in abnormal returns around earnings announcements, following the finance literature (Dierkens 1991). The results reported here are based on the average reaction in the financial market for four quarterly earnings announcements in a given year. To ensure the robustness of using this "event", I run five different models using four announcement reactions from four quarterly earnings announcements in a given year separately, and using their average. Primary results remain unchanged.

observe higher levels of information asymmetry for the completed sample relative to the matched sample but not relative to the withdrawn sample. The top panel of Table 5 summarizes the differences in the levels of information asymmetry between the samples at the merger announcement. The average *IA_anno* for the completed sample is 0.2581, which is significantly greater than that of the matched sample (0.0444), but is not statistically different from that of the withdrawn sample (0.1639) at the 1 percent level. The difference between the withdrawn sample and matched sample (0.1195) is statistically significant at the 5 percent level. The results are consistent with the proposition that mergers increase the degree of information asymmetry.

Second, I study the degree of information asymmetry for 5 years around the merger year for all three samples. I expect that the degree of information asymmetry peaks in merger year for both the completed and withdrawn samples but not in matched control sample. The bottom panel of Tale 5 summarizes the differences in the levels of information asymmetry between samples for 5 years. The average *IA_resi* for both completed and withdrawn samples peaks in the merger year compared to the non-merger years, while the peak is not observed for the matched sample. The mean difference for the completed sample between year *t* (0.0736) and year *t-1* (0.0238), and the mean difference for the withdrawn sample between year *t* (0.0678) and year *t+1* (0.0467) are both significant at the 1 percent level. Note that there is a "sticky" pattern of uncertainty reduction for the withdrawn sample, which suggest that the withdrawal of merger reveals negative information and maintains a certain degree of information asymmetry post-merger. In the merger year, the mean difference between the completed and withdrawn samples (0.0058) is insignificant. However, the mean difference between the completed and withdrawn samples in year *t+1* (-0.0234) and *t+2* (-0.0091) is significant. Overall, the results presented in Table 5

support the notion that mergers increase the degree of information asymmetry in the stock market.

Table 5
Descriptive Statistics of the Changes in Information Asymmetry in a Merger

			(1) Completed Sample	(2) Matched Sample	(3) Withdrawn Sample	Difference (1)-(2)	Difference (1)-(3)
IA_anno (-1, +1)		Mean	0.2581	0.0444	0.1639	0.2137***	0.0942
		Median	0.2561	0.0373	0.1492	0.2188***	0.1069
IA_resi	Mean	year *t-2*	0.0227	0.0256	0.0221	-0.0029	0.0006
		year *t-1*	0.0238	0.0244	0.0239	-0.0006	-0.0001
		Year *t*	0.0736	0.0234	0.0678	0.0502***	0.0058
		year *t+1*	0.0233	0.0237	0.0467	-0.0004	-0.0234**
		year *t+2*	0.0228	0.0248	0.0319	-0.0020	-0.0091*
	Median	year *t-2*	0.0195	0.0165	0.0164	0.0030	0.0031
		year *t-1*	0.0183	0.0171	0.0168	0.0012	0.0015
		Year *t*	0.0294	0.0168	0.0271	0.0126***	0.0023
		year *t+1*	0.0186	0.0162	0.0251	0.0024	-0.0065**
		year *t+2*	0.0189	0.0161	0.0236	0.0028	-0.0047**

*** $p < .01$, ** $p < .05$, * $p < .10$

Note: The *IA_anno* (-1, +1) is the standard deviation of the market-adjusted, three-day (-1, +1) abnormal returns around the merger announcement. The *IA_resi* is the standard deviation of the market-adjusted daily stock price abnormal return in the corresponding year given that a merger occurs at year *t*. Tests on means and medians are based on *t*-tests and Wilcoxon tests, respectively.

Mergers and Marketing Investments

Hypothesis 1 predicts that an acquirer increases its marketing investments pre-merger and then decreases its marketing investments post-merger. To test, I run the following regression:

$$\text{Marketing Investment}_{it+1} - \text{Marketing Investment}_{it+k} = \beta_0 + \beta_1(M\&A_{it+1} - M\&A_{it+k}) + \beta_2(Contorl_{it+1} - Control_{it+k}) + \varepsilon_i \quad (1)$$

where *i* stands for firm, *t* for time (year) and k = -2, -1, 0. *Marketing Investment* a firm's advertising expenditure scaled by its total asset. *M&A* is a dummy variable equal to 1 if the

merger is announced in the previous year and 0 otherwise. *Control* is a vector of control variables that could affect an acquirer's marketing investment: *financial flexibility*, *size*, *book-to-market ratio*, *market share*, and *cashpmt*. All control variables are defined as illustrated in Data and Measures section. I also control for a firm's *lagged marketing investment*, *year*, and *industry*. Finally, I control for cross-sectional heterogeneity across firms by running a random effect regression. In equation (1), β_1 is the primary interest because it gauges the difference in marketing investments between a year following a merger announcement (year *t+1*) and the pre-merger years (year *t-2*, year *t-1*, and year *t*). A firm's marketing investment changes in year *t+1* could occur due both to the firm's anticipation of merging and to the firm's product market considerations. In equation (1), after controlling for the effects of several product market factors (*Control* vector), β_1 captures the portion of changes in marketing investments that is attributable to a merger decision. This model more accurately calculates the average adjustments level in marketing investment that is associated with the managers' post-merger decision than autoregressive model (Chemmanur and Yan 2009). I expect β_1 to be significantly negative for the completed sample to be consistent with H1.

Table 6 presents the results from equation (1) with Year *t-2*, *t-1*, or *t* as pre-merger years for all three sample groups. First, the coefficient of M&A, β_1, is significantly negative for the completed sample, suggesting that a successful acquirer's reduce their marketing investments in a year following a merger announcement relative to pre-merger years. On average, an acquirer decreases its marketing investment by 1.4 percent relative to its total asset from year *t-2* to year *t+1*, by 1.1 percent from year *t-1*, and by 0.12 percent from year *t*.

Table 6

Marketing Investment Changes between the Merger Year and Non-Merger Year

	Completed Sample			Matched Sample			Withdrawn Sample		
	(Year *t+1*) - (Year *t-2*)	(Year *t+1*) - (Year *t-1*)	(Year *t+1*) - (Year *t*)	Δ(*t-2*)	Δ (*t-1*)	Δ (*t*)	Δ(*t-2*)	Δ (*t-1*)	Δ (t)
M&A	-0.014 ***	-0.011 ***	-0.012 **	0.010 **	0.007 **	0.011 **	0.013 ***	0.009 **	0.000
	(0.004)	(0.003)	(0.006)	(0.006)	(0.003)	(0.006)	(0.005)	(0.005)	(0.004)
Financial Flexibility	0.009 ***	0.011 **	0.041 ***	0.010 **	0.016 ***	0.009 **	0.011 **	0.027 **	0.005 **
	(0.003)	(0.004)	(0.004)	(0.005)	(0.006)	(0.005)	(0.005)	(0.012)	(0.002)
Size	0.032 **	0.019 ***	0.006 **	0.003 **	0.001 **	0.000 **	0.010 **	0.007 **	0.011 **
	(0.015)	(0.006)	(0.003)	(0.002)	(0.000)	(0.000)	(0.005)	(0.003)	(0.005)
Book-to-Market Ratio	0.006 *	.008	0.002	0.003 *	0.002	0.002	0.007 *	0.006	0.005
	(0.003)	(0.006)	(0.003)	(0.002)	(0.002)	(0.003)	(0.004)	(0.004)	(0.005)
Market Share	-0.147	-0.111	0.123	0.008	-0.021	0.036 *	-0.046	-0.147	0.161
	(0.100)	(0.893)	(0.076)	(0.006)	(0.035)	(0.020)	(0.029)	(0.132)	(0.098)
Lagged Marketing Investment	0.619 ***	0.712 ***	0.825 ***	0.783 ***	0.801 ***	0.86 ***	0.61 ***	0.897 ***	0.611 ***
	(0.029)	(0.036)	(0.039)	(0.016)	(0.015)	(0.014)	(0.033)	(0.036)	(0.023)

*** $p < .01$, ** $p < .05$, * $p < .10$

Note: This table summarizes the results from the random effect regression on Marketing Investment in the merger year and non-merger year. The *Marketing Investment* a firm's advertising expenditure scaled by its total asset. The independent variables consist of *M&A*, a dummy variable equal to 1 if the merger is announced in the previous year and 0 otherwise; *Financial Flexibility*, a ratio of the sum of debt in current liabilities, long-term debt, and cash to total assets; *Size*, the relative size of the firms measured by the relative equity; *Book-to-Market Ratio*, a ratio of the natural log of book value of common stock to the natural log of the product of number of shares outstanding and end-of-year- stock price; *Market Share*, a firm's sales relative to industry sales in the past year. Industries are identified using two-digit SIC codes.

Table 6 also exhibits the results for the matched and the withdrawn samples. The β_1 for the matched sample is significantly positive over the years, suggesting that an acquirer's rivals increase their marketing investment in year *t+1* as expected. Competitors seek to take advantage of an acquirer's temporary financial inflexibility by aggressively investing in marketing. The β_1 for the withdrawn sample is significantly positive prior to a merger but is insignificant following a merger, suggesting that the failed acquirers increase their marketing investments in the merger year but not in the following year. Overall, the results show that a successful acquirer aggressively invests in marketing pre-merger and then reduces its marketing post-merger, supporting H1.

Information Asymmetry, Marketing Investments, and Firm Value

Table 7 presents the results of a univariate analysis that directly investigates whether the short-term abnormal returns (in year *t+1*) differ across post-merger marketing investment. The results demonstrate the effect of two post-merger marketing investment strategies, spending more or less than industry average, under different degrees of information asymmetry. Two measures of information asymmetry, *IA_anno* and *IA_resi*, are used. An acquirer is classified to have a "high" ("low") degree of information asymmetry when a firm falls into the top (bottom) quartile of portfolios sorted on each information asymmetry proxies.

The results reveal significant differences of effects of marketing investment on abnormal returns. When the degree of information asymmetry is high, the short-term abnormal returns are significantly higher for firms investing more in marketing than industry average (0.0114 vs. -0.0089 and 0.0103 vs. -0.0127), which is consistent with H2 and H3. More importantly, spending less than rivals in marketing post-merger may lead to a significant loss of financial firm value (-0.0089 and -0.0127). Even if the information asymmetry induced by the merger announcement is

low, proactive marketing investments results in significantly positive stock prices (0.0078). The results also show that some acquirers can benefit from investing less in marketing (0.0081), which explains why acquirers tend to reduce their marketing post-merger, as presented in Table 6. However, Table 7 offers preliminary evidence that not all acquires can gain from passive marketing activities. The results suggest that when ignoring a critical moderating factor such as the degree of information asymmetry, managers might mistakenly conclude that investing less in their marketing relative to rivals does not affect stock prices following a merger.

Table 7
Abnormal Returns under Different Post-Merger Marketing and Information Asymmetry

	Degree of Information Asymmetry Around Merger Announcement (IA_anno)		Degree of Information Asymmetry in Merger Announcement Year (IA_resi_t)	
	High	Low	High	Low
Investing MORE than rivals	0.0114***	0.0078**	0.0103**	0.0065
Investing LESS than rivals	-0.0089**	-0.0043	-0.0127***	0.0081*

*** $p < .01$, ** $p < .05$, * $p < .10$
Note: The short-term abnormal return reported here is cumulative abnormal return calculated by using 12 monthly stock returns in year *t+1*, starting from the January after a merger is announced. A firm is classified on the basis of whether its marketing investment in year *t+1* is greater than industry average or not. Industries are identified using two-digit SIC codes. The *IA_anno* is the standard deviation of the market-adjusted, three-day (-1, +1) abnormal returns around the merger announcement. The IA_resi_t is the standard deviation of the market-adjusted daily stock price abnormal return in the merger year. A firm is classified to have a "high" ("low") degree of information asymmetry when a firm falls into the top (bottom) quartile of portfolios sorted on the basis of *IA_anno* and IA_resi_t.

Dynamic Panel General Method of Moments (GMM)

To further examine the impact of post-merger marketing investments and information asymmetry, I specify a cross-sectional model as:

$$\text{Performance}_{it+k} = \beta_0 + \beta_1 \text{Relative Marketing}_{it+1} + \beta_2 \text{ Information Asymmetry}_{it} + \beta_3 \text{ Relative Marketing}_{it+1} * \text{Information Asymmetry}_{it}$$

$$+ \beta_4 \text{ Performance}_{it+k-1} + \beta_5 \text{ Control}_{it+1} + \eta_i + \varepsilon_{it+1} \quad (2)$$

where *i* stands for firm, *t* for time (year), and *k*=1, 2. The dependent variable, *Performance*, is either short- or long-term stock performance. Short-term performance (*k*=1) uses 12 consecutive monthly stock returns starting from the January after a merger is announced. Long-term performance (*k*=2) uses 24 consecutive monthly stock returns. To incorporate the competitive factors in marketing investments within a firm's industry, the industry-level average of marketing intensity is calculated using the ratio of each firm's marketing investment to its total asset. *Relative Marketing* is a difference between the marketing intensity of a focal firm and industry average. Industries are identified using two-digit SIC codes. *Information Asymmetry* is either IA_anno, the standard deviation of the market-adjusted, three-day (-1, +1) abnormal returns around the merger announcement, or IA_resi, the standard deviation of the market-adjusted daily stock price abnormal return in the merger announcement year. *Control* is a vector of control variables including financial flexibility, size, book-to-market ratio, market share, cashpmt, and merger type. The η_i is a time-invariant unobservable firm fixed effect and ε_{it+1} is a random error representing all unobservable components on the dependent variable.

As discussed earlier, both heterogeneity and endogeneity display empirical challenges in studying mergers, marketing investment, and firm performance simultaneously. Previous studies tend to follow Heckman's two-step method. However, marketing investment may also be endogenously determined here (Kurt and Hulland 2013). For instance, current marketing capability influences merger success in addition to the merger decision itself. This, in turn, impacts a firm's future marketing investment and performance. The Heckman model may lead to a biased estimation in this instance, as it considers marketing investment as exogenous. Hence, I use the dynamic panel GMM model to control for such a dynamic endogeneity, simultaneity, and

heterogeneity. Past research has shown that dynamic panel GMM is preferable over fixed effects or Heckman's model to handle the empirical challenge (Arellano and Bover 1995; Blundell and Bond 1998; Dutt and Padmanabhan 2011; Rego et al. 2013; Kumar et al. 2014).[8]

Here, the dynamic panel GMM estimation consists of four steps. First, I begin with a "levels-levels" model specification that includes firm performance as a dependent variable and both marketing investments and one-year lagged performance as independent variables (eq. 2). Second, the estimation proceeds by first differencing all variables in the equation, eliminating firm and year fixed effects as well as potential omitted variables bias. Third, I use the first two lagged values of variables as instruments. Still, endogeneity remains unsolved because Δ Marketing Investment_{it+1} can be influenced by Δ $\text{Performance}_{it.}$ Finally, I use the two-stage least squares (2SLS) method where the predicted value of marketing investment can be obtained using the instrument variables, past performances. I employ a difference GMM estimator using the predicted value of marketing investment as an independent variable in the aforementioned model.

The inherent weakness of dynamic panel GMM model arises due to the use of internal instrumental variables, which raises a potential problem of determining the optimal length of lags. Specifically, increasing the number of lags to be more exogenous may lead to the instruments of weaker validity. Following previous studies (Dutt and Padmanabhan 2011; Rego et al. 2013; Kumar et al. 2014), I include lags of one and two years. This allows for a sufficient horizon for past information to affect current performance expectations (Wintoki et al. 2012; Hoechle et al. 2012). In addition, I report the Hansen J and C statistics for the validity of instruments provided

[8] If it is believed that there is a dynamic relationship between present values of the independent variable and past values of the dependent variables, the fixed-effects model is more likely to be biased (Arellano and Bover 1995; Blundell and Bond 1998). In the presence of a lagged dependent variable as the independent variable, the fixed effect estimator is consistent only when T is large: the lagged dependent variable is correlated with the error term, but this correlation goes to zero as T gets large. With T greater than 30, this correlation should vanish, and the fixed effect estimator is likely to be consistent. I employ the GMM procedure in this study, as T is less than 30.

by two tests, the Hansen test of over identification and a difference-in-differences Hansen test of exogeneity, with AR(1) and AR(2) test statistics.

The dynamic panel GMM model estimation results for all three samples are presented in Table 8. In addition to the estimation results for the central parameters of interest, the test statistics of model fit, serial correlation, and instrument variable validity are reported. All the serial correlation and instrument validity tests support the use of dynamic panel GMM model proposed. Pertaining to the hypothesized main effects for the completed sample, results using IA_resi$_t$ show that marketing has significantly positive impacts on the following years' stock returns (year+1: 3.533, year+2: 2.215), supporting H2. The coefficients indicate that the positive signaling effect of aggressive marketing investments relative to industry rivals dominates. While marketing has a positive effect for the matched sample (year+1: 2.137), the positive effects are stronger and longer ($p < 0.05$) for the acquirers. It may be that when a firm experiences a merger, marketing becomes more powerful as a signal and therefore a necessity of marketing investments increases. With respect to the contingent effects of information asymmetry, the interaction between marketing and information asymmetry has a positive effect on stock return (year+1: 1.548, year+2: 1.214). The positive relationship between post-merger marketing and information asymmetry is stronger and longer ($p < 0.01$) for a successful-acquirer sample than for matched-firm (year+1: 1.116) and withdrawn-acquirer samples (year+1: 1.971). Considering the positive main effect of marketing on performance, the positive significant interaction suggests that when the degree of information asymmetry is higher, marketing has an even larger effect on performance. These results also hold when *IA_anno* is substituted into the same equation. To ensure the significance of the moderating factor, I also estimate the GMM model without considering information asymmetry factors and its interaction with marketing investment. Model

fit improves when incorporating the information asymmetry factors. The presence of direct and indirect effects of information asymmetry leads to identification of conditions under which marketing investment post-merger can positively contribute to stock return. These results demonstrate that elevated information asymmetry strengthens the positive effect of an acquirer's post-merger marketing on firm value. Overall, the results supports H3, which predicts that information asymmetry moderates the link between marketing and performance, and implies that marketing is an effective tool to enhance firm value by delivering information to the financial market under high uncertainty.

Table 8

Dynamic Panel GMM Estimation Results: All Samples

DV: Stock Performance	Information Asymmetry: IA_anno (-1, +1)						Information Asymmetry: IA_resi$_t$					
	Completed Sample		Matched Sample		Withdrawn Sample		Completed Sample		Matched Sample		Withdrawn Sample	
	Year +1	Year +2	Year +1	Year +2	Year +1	Year +2	Year +1	Year +2	Year +1	Year +2	Year +1	Year +2
Marketing	2.397 ***	1.587 **	1.845 **	0.815	2.862 **	1.682	3.533 ***	2.215 *	2.137 ***	1.170	2.145 **	1.514
	(0.90)	(0.79)	(0.92)	(0.94)	(1.21)	(1.06)	(1.13)	(1.05)	(0.82)	(0.96)	(1.08)	(0.95)
Information Asymmetry	-1.681 ***	-0.871	-1.351 **	-0.927	-1.837 **	-1.371	-4.351 ***	-2.179 *	-1.061	-1.073	-2.296 ***	-1.374
	(0.64)	(0.68)	(0.65)	(0.63)	(0.84)	(0.88)	(1.08)	(1.39)	(0.65)	(0.68)	(0.87)	(0.93)
Marketing *Information Asymmetry	1.216 **	1.037 *	1.483 ***	1.143	1.638 **	1.337	1.548 ***	1.214 **	1.116 **	0.732	1.971 ***	1.236
	(0.60)	(0.58)	(0.54)	(0.62)	(0.70)	(0.71)	(0.50)	(0.57)	(0.55)	(0.51)	(0.73)	(0.79)
Lagged Stock Performance	0.915 ***	0.852 ***	1.412 **	1.041	0.562 *	0.268	0.914 **	0.643 **	1.371 **	0.847	0.316	0.115
	(0.31)	(0.32)	(0.66)	(0.63)	(0.32)	(0.36)	(0.46)	(0.301)	(0.68)	(0.66)	(0.34)	(0.39)
Financial Flexibility	-0.349	-0.318	-0.291 *	-0.203	-0.422 ***	-0.337 *	-0.260 *	-0.134	-0.222	-0.137	-0.390 **	-0.351 **
	(0.27)	(0.24)	(0.13)	(0.12)	(0.20)	(0.21)	(0.14)	(0.13)	(0.17)	(0.14)	(0.23)	(0.25)
Size	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)
Book-to-Market Value	1.637 ***	1.548 **	1.216 **	1.009 **	2.123 ***	1.829 ***	1.738 **	1.602 **	1.518 ***	1.117 **	1.952 ***	1.720 **
	(0.62)	(0.65)	(0.54)	(0.47)	(0.76)	(0.68)	(0.65)	(0.67)	(0.52)	(0.52)	(0.74)	(0.73)
# Obs.	2855	2838	2855	2855	589	578	2855	2838	2855	2855	589	578

Wald	2103	2503	1975	2762	173	254	2234	2610	2856	2176	314	251
AR(1)	0.04	0.02	0.02	0.09	0.01	0.03	0.03	0.03	0.01	0.06	0.02	0.01
AR(2)	0.15	0.24	0.31	0.24	0.36	0.42	0.27	0.18	0.47	0.16	0.27	0.35
Hansen J	0.48	0.41	0.40	0.48	0.22	0.27	0.33	0.34	0.21	0.25	0.29	0.16
Hansen C	0.55	0.32	0.42	0.41	0.12	0.19	0.12	0.38	0.39	0.28	0.24	0.18

*** $p < .01$, ** $p < .05$, * $p < .10$

Note: This table summarizes the results from the dynamic panel GMM model of stock performance for year+1 and year+2 following a merger announcement on marketing, information asymmetry, lagged stock performance, and controls. The dependent variable, *Performance*, is either short- or long-term stock performance. Short-term performance (k=1) uses 12 consecutive monthly stock returns starting from the January after a merger is announced. Long-term performance uses 24 (k=2) consecutive monthly stock returns. *Marketing* is the difference between the marketing intensity of a focal firm and industry average. Industries are identified using two-digit SIC codes. *Information Asymmetry* is either IA_anno, the standard deviation of the market-adjusted, three-day (-1, +1) abnormal returns around the merger announcement, or IA_resi$_t$, the standard deviation of the market-adjusted daily stock price abnormal return in the merger announcement year. CONTROL is a vector of control variables including *Financial Flexibility*, a ratio of the sum of debt in current liabilities, long-term debt, and cash to total assets; *Size*, the relative size of the firms measured by the relative equity; *Book-to-Market Ratio*, a ratio of the natural log of book value of common stock to the natural log of the product of number of shares outstanding and end-of-year stock price. The Wald χ^2statistics show the model fit. The AR(1) and AR(2) statistics are used to test serial correlation and Hansen J and Hansen C statistics are used to test the validity of instrument variable. The *p*-values are reported for all serial correlation and instrument validity tests.

Table 8 also reveals, with respect to non-hypothesized effects for withdrawn sample, that marketing has a positive effect (year+1: 2.145), information asymmetry has a negative effect (year+1: -2.296), and the interaction term has a significant positive effect (year+1: 1.197) of stock return. Collectively, this may indicate that when a firm fails to complete a merger, an aggressive marketing can be interpreted as a recovery effort in order to reduce the negative effects of the news in the financial market. For investors, the cancellation of the merger proposal reveals negative information about the merging firms such as poor growth opportunity or incompetency of management. Chi-square tests indicate that the net impact of marketing, calculated as a sum of three coefficients of the direct and indirect effects (1.046), is statistically positive and different from zero at the 5 percent level. This noteworthy finding suggests that a marketing manager at such a firm may adopt a more aggressive marketing post-cancellation to prevent potential performance loss. In addition, this finding further supports H3 because the withdrawn sample is also a subject of higher information asymmetry in year *t* as shown in Table 5. This finding confirms that adopting a marketing investment decision that considers the degree of information asymmetry may be an important part of strategy with respect to firm value.

2.6 Conclusion

Discussion

The objective of this study is to examine *whether and how mergers influence marketing investment and its impact on firm performance in financial market*. Acquirers use large amounts of capital for merger transactions that otherwise could finance new marketing projects. I examine whether acquirers are willing to invest more in marketing and whether such spend compensates. I find that, on average, acquirers invest significantly less in marketing than their rivals post-merger. By using a dynamic panel GMM method, I show that acquirers would gain significantly

if they invested more than their competitors. However, not all acquirers benefit equally. The results demonstrate the contingent role of information asymmetry on a subset of main effects. I observe that the impact of marketing investment is stronger and longer when the degree of information is high.

Theoretical Implications

This study enriches the market-based assets literature (Srivastava et al. 1998) by demonstrating the role of marketing investment in a merger. To the best of knowledge, this study is one of the first to link marketing investments with a merger transaction and firm value. This unique perspective offers important insights into marketing strategy and performance of acquiring firms. However, the findings are not limited to mergers and acquisitions. For example, they could be extended to other strategic decisions of a firm under the circumstances in which the necessity of aggressive marketing competes with financial inflexibility. In addition, this study adopts the emerging contingency perspective by theoretically addressing and empirically showing that the degree of information asymmetry moderates the relationship.

Furthermore, the findings advance empirical research on mergers and acquisitions on several fronts. First, I show the potential of the market-based asset framework in resolving complex problems, such as merger success. Strategic fit and integration procedure are among the most important and widely studied factors affecting merger success. However, this study presents strong support for marketing investment as an unidentified key variable (King et al. 2004) in explaining the merger gain. Second, whereas most prior empirical studies have modeled successful acquirers only, this article introduces a new benchmark sample with withdrawn merger deals. This novel comparison of two groups may contribute to the literature by offering more options to marketing scholars. Finally, I use robust economic models, dynamic panel GMM,

to reveal the moderated, simultaneously endogenous, and heterogeneous effects of post-merger marketing spending.

Managerial Implications

It has been said that acquirers' attention is more likely to be taken away as they are dealing with suddenly increased firm size, new environments, and complicated integration tasks and managers are more likely to have fewer resources available for marketing strategy. In fact, the results show that combined firms significantly decrease marketing investment post-merger. However, I advocate the opposite. Executives may consider allocating capital to marketing for at least two reasons. First, aggressive marketing limits uncertainty about the merger decision. Second, business performance can be improved due to the signaling role of marketing. However, firms have finite resources in post-merger years, hindering their willingness to invest. A typical observation is that a firm prioritizes investment by sorting it into necessity and discretionary. What's usually missing is a careful cost-benefit analysis that establishes the credibility of marketing investment. This study helps acquiring firm managers understand intricacies of the post-merger marketing. Although the opportunity cost tends to increase sharply, it would be disastrous for an acquirer to cut marketing investments.

Accordingly, I provide several prescriptive guidelines. First, post-merger marketing programs should be designed in the most efficient and effective way. Acquirers already have the financial influence of the merger. However, recognizing that post-merger investments enhance firm value, acquirers can benefit from devoting more resources to pre-determined marketing strategies. Second, clear communication about the rationale for the merger and the ensuing marketing investment to customers and investors decreases concerns. Past studies highlight the importance of a firm's information disclosure strategy in several contexts (Mizik and Jacobson

2007; Swaminathan et al. 2008; Kurt and Hulland 2013). Third, the findings suggest that firms need to ensure that they have superiority with respect to industry rivals' marketing investments. Neither benchmarking nor investing more is a trivial task for the acquirer. Yet the findings suggest that such extra marketing efforts may be worthwhile. Finally, this research highlights the need for an immediate advertising investment, as suggested by Tables 7 and 8. In sum, when designing post-merger marketing project, managers need to allocate budgets while accounting for its effectiveness, rivals' investment, information asymmetry, and shorter-term time horizon of execution.

Limitations

This study has several limitations. First, the use of advertising expenditure as a proxy is limited. Although I believe advertising captures a more relevant facet of marketing in a merger context (McAlister et al. 2007), it would be worthwhile to examine the importance of marketing as a source of information in several directions. For example, in some industries, the role of advertising may be limited, and future studies may wish to employ alternative measures. Future research also may explore the importance of the quality of marketing. Second, this study suggests that acquirers can outperform competitors as a result of the communication with investors. If so, what other kind of channels of communication are common? For firms with poor advertising or that are in industries in which advertising is less effective, other sources of information, such as R&D and production capability (Capron and Hulland 1999; Prabhu et al. 2005), or the official statement of executive managers when announcing a merger can be of worthy of attention.

CHAPTER 3 – ESSAY 2: POST-MERGER RETURNS TO MARKETING PRODUCTIVITY

3.1 Introduction

This dissertation focuses on understanding marketing accountability by investigating the links among marketing investments, marketing productivity, and firm value. While the relations between marketing investments and firm value is studied in the previous chapter, less is explored about the links between marketing productivity and firm value. The current chapter examines the relationships by analyzing 1) the sources and effects of merger-induced changes in marketing productivity, and 2) the links between marketing and other functions in creating firm value and competitive advantage.

Researchers have recently begun to measure marketing productivity (for a summary, see Rust et al. 2004). However, there are three main challenges to estimating marketing productivity that researchers face: 1) investigating the long-term effect of marketing actions (Dekimpe and Hanssens 1995), 2) disentangling the individual effect of marketing actions from other functional actions (Bonoma and Clark 1998), and 3) justifying marketing actions with both financial and nonfinancial metrics (Marketing Science Institute, 2000). Despite a number of attempts at modeling marketing credibility, comprehensive approaches are lacking (Rust et al. 2004). The dearth of research in this area is primarily because most studies have only emphasized discrete facets of marketing productivity (Table 1 and 2). As such, theoretical and empirical analysis, which would provide a marketing manager with holistic assessment and diagnosis and also implementable guidelines, are needed. The capability approaches taken by Dutta et al. (1999)

and Narasimhan et al. (2006) are exceptions. In these studies the authors measure the capability of marketing and other functional areas in tandem. To the best of knowledge, these are the first empirical analyses that provide accounts of multi-faceted aspects of marketing productivity. However, these studies still lack practical guidelines tailored to marketing managers. To address the aforementioned gaps in the literature, the current study designs a test and then provides empirical evidence while considering a firm's marketing investment, marketing productivity, and firm value. In particular, the study focuses on two aims: 1) the relation between marketing spend and marketing productivity post-merger, and 2) the impacts of changes in marketing productivity on firm value.

To investigate these aims, I use data from several sources including the Securities Data Corporation (SDC)'s Thompson Merger and Acquisition database, COMPUSTAT of Standard & Poor's, and Chicago Booth's Center for Research in Security Prices (CRSP). The final sample consists of 153 public U.S. acquirers in chemical and rubber, and electronic equipment and automotive industry. These specific industries are chosen because they are characterized by intensive use of marketing assets as well as other functional assets. Because the relations and changes between marketing investment, marketing productivity, and firm value through a merger are of great importance, focusing on these markets provides an ideal research setting. In addition, an empirical method that can accommodate the unique characteristics of the merged dataset is required. Therefore, I utilize the Data Envelopment Analysis (DEA) to measure marketing productivity. This method allows for the identification of a set of action priorities for marketing managers and quantification of the gains of implementing such strategies.

An initial examination of the data shows that, on average, mergers lead to acquirers' significant disinvestment in their marketing post-merger. However, empirical results show that,

in fact, increases in marketing are associated with increases in sales post-merger. As predicted in microeconomics literature by the law of diminishing returns to scale, it is clear that the productivity increases as the quantity of inputs used decreases. The increase in productivity post-merger may demonstrate the usefulness of a disinvestment, however, firms that reduce their marketing investment may face a loss of stock returns. Specifically, the empirical results show a negative association between the productivity increase and firm value. This juxtaposition could lead to difficult decisions for the marketing manager. In sum, superior marketing investment is more likely to lower the level of marketing productivity, but this low productivity tends to achieve higher stock prices. Theoretical valuation for the negative association between marketing productivity and firm value is that the financial markets selectively perceive information contained in marketing investment about the future marketing productivity, and resultant, future firm value. Investors, acknowledging the law of diminishing returns, may place less weight on the potential changes in productivity because they believe that productivity reduction is inevitable during the merger process and, as such, productivity adjustment may be less indicative of future prospects. As discussed in Chapter 2, investors view an increase in marketing investment as a credible tool managers can use in order to reduce the degree of information asymmetry and to maintain competitive advantage, especially in the post-merger period.

The objective of this study is to understand the link between marketing investment, marketing productivity, and firm value. An empirical investigation is conducted to measure marketing and other functional areas' productivity. This study articulates a measurement and an empirical approach that offers a set of actionable guidelines for marketing managers. Thus, the contribution of this study is twofold: the provision of holistic assessment and diagnosis, and a set of actionable and implementable guidelines.

3.2 Conceptual Framework

Resource-Based View and M&A

I develop a theoretical model based on the resource-based view (RBV). The RBV explains why firms have different performance expectations by highlighting the importance of particular resources owned and controlled by a firm (Barney 199; Wernerfelt 1984). A firm generates more economic value than competitors by taking advantage of different bundles of resources (e.g., marketing). Barney (1991) identifies four resource requirements to achieve sustainable competitive advantage: valuable, rare, imperfectly immobile, and unsustainable attributes. According to the RBV, a merger and acquisition occurs because resources are both heterogeneous and imperfectly mobile and, subsequently, competitive advantage generates at the specific firm level. In responding to competitive demands, mergers are often used as a way to acquire a pertinent target with unique resources (Capron and Hulland 1999; Homburg and Bucerius 2005; Sorescu et al. 2007; Swaminathan et al. 2008). Acquisitions provide an important means to capture growth opportunity by creating value from combining existing and newly obtained resources. Through mergers and acquisitions, both merging firms avoid having to deal with the limits of the internal development of growth opportunity that they might have faced without a merger.

This study examines shocks (merger and acquisition) to a firm to assess the impact of changes in a firm's investment and productivity on firm value. The performance assessment of a firm is an important research domain considered in several literatures including marketing, strategy, economics, finance, and accounting. For example, Murthi et al. (1996) point out three dimensions of marketing: 1) input resources that are necessary for the production of desired output, 2) output objectives that differentiate a firm relative to its rivals, and 3) efficiency, which

refers to a firm's ability to deploy inputs to achieve the output. In general, productivity is defined as a ratio of outputs to inputs. This study adopts the input-output approach similar to the functional capabilities proposed by Dutta et al. (1999). These authors conceptualize a firm in the high-technology industry as consisting of systems including marketing, R&D, and operation capabilities to explain interfirm profitability heterogeneity. Although I follow established models (Murthi et al. 1996; Dutta et al. 1999), this study advances the framework by explicitly including shocks that create modifications in input, output, and productivity. Because this model includes shocks, it requires a different conceptualization, which includes combining the variables (input, output, and productivity) of both merging firms (acquirer and target) into a single model. This new conceptualization allows for inferences to be drawn about the relations and changes among variables as a direct result of a merger and acquisition. To the extent that acquiring scarce and imperfectly immobile resources is the ultimate objective of a merger, it is imperative to construct the model by integrating the productivity of both firms. I also use a second-stage approach that conceptualizes stock return as an output variable, instead of profit (Dutta et al. 1999; Narasimhan et al. 2006). This modification is primarily motivated by an interest in financial market outcomes. Given that the merger increases uncertainty, the shifts in investment and productivity are of a particular interest to researchers and to practitioners. In addition, it is critical to use output metrics that are independent of variables used in the first-stage analysis as inputs or outputs, in order to restore a valid measure of productivity.

The following sections introduce the input resources and output objectives used in the first-stage to estimate productivity measures.[9] To build a portfolio of inputs and outputs, the

[9] The dependent variables of productivity equations are defined following recommendations set forth by Dutta et al. (1999) and Narasimhan et al. (2006).

first-stage considers marketing, Research & Development (R&D), and operation assets, both tangible and intangible.

Marketing Productivity

Sevin (1965) defines marketing productivity as "the sales or profit per unit of marketing effort". In the studies on the utility and operationalization of marketing, marketing effort is classified into several actions such as advertising, supply chain management, innovation, and customer relations (Dutta et al. 1999; Narasimhan et al. 2006). In keeping with the research tradition (Srinivasan and Hanssens 2009; Steenkamp and Fang 2011; Kurt and Hulland 2013), I use such marketing activities as input variables to model marketing productivity. A firm that spends more on advertising campaigns will be able to achieve superior sales by increasing customer awareness and brand equity. For example, because customers are already familiar with the product, advertising can supplement the selling effort of salesperson. With an increased brand equity and loyalty, marketing can serve as an entry barrier. Better customer relations enables a firm to be better at identifying customer needs, and will thus be better at targeting and positioning. Because the status of a company's relationship with customer is accurately tracked, companies can achieve more and faster sales and higher customer retention and satisfaction. Furthermore, R&D can help a frim build advantage over its competitors by bringing innovative products and services to the market, which leads to a sharp increase in market participation and sales (Prabhu et al. 2005). Firms with higher marketing productivity can carry out better sales forecasting and respond quickly to changes in order to capitalize on new opportunities. Hence, above discussion and insights from the literature allow for a formulation of marketing productivity as a function of:

Sales = f (Adverting Capital, Marketing Capital, R&D Capital, Customer Base)

R&D Productivity

The primary goal of R&D is the creation of new body of knowledge about existing products or processes, or the creation of an entirely new product (Prabhu et al. 2005). By definition, R&D investment is the single most essential input to developing innovations (Dutta et al. 1999; Narasimhan et al. 2006). Another important input is a firm's marketing productivity. In fact, a firm with stronger marketing assets better understands customer experience, and therefore, can better identify promising innovation opportunities. Marketing can further increases R&D output by providing directions to differentiating a firm's product (Erickson et al. 1992). The R&D output has been frequently measured in the literature using patent counts (Dutta et al. 1999) because patent rights can give monopoly power to a firm. Patent plays a critical role in achieving a superior competitive advantage and establishing an entry barrier for manufacturers in the markets under investigation in this study (Mizik and Jacobson 2003). Furthermore, acquiring patent rights and/or resolving patent dispute through a merger is one of popular strategies to reduce competition. I follow an approach that uses the quality-adjusted patent[10] as an output variable in measuring R&D productivity to overcome some shortcomings of the raw patent data (Dutta et al. 1999). Hence, above discussion and insights from the literature allow for a formulation of R&D productivity as a function of:

Quality-adjusted Patent = *f* (R&D Capital, Marketing Productivity, Patent Base)

Operation Productivity

Operation productivity refers to cost minimization (Dutta et al. 1999; Narasimhan et al. 2006), rather than production maximization. Hence, I use production cost minimization as an

[10] This measure uses the number of times a patent has been cited to count for the innovativeness of R&D technology, which allows for incorporating two dimensions of R&D outputs: innovativeness and applicability.

output objective in measuring operation productivity. Following microeconomic theory, factor prices such as labor and capital costs are considered input variables (Banker et al. 1984; Charnes et al. 1978). Another key driver is a firm's R&D assets because technology can lead to a lower cost structure. A firm's technological assets play a critical role in shaping a firm's production process, which contributes to higher operation productivity. Finally, marketing can help the operational function of a firm by providing insights about customer behavior. A firm with stronger marketing assets better understands customers' buying behavior, and therefore, will be able to control inventory better than competitors. This ultimately can drop costs related to selling, storage, and shipping (Dutta et al. 1999; Narasimhan et al. 2006). Hence, above discussion and insights from the literature allow for a formulation of operation productivity as a function of:

Production Cost = *f* (Labor Cost, Capital Cost, R&D Capital, Marketing Productivity)

Productivity, Mergers, and Firm Value

There is a growing literature in marketing, finance, and accounting that investigates the relations between a firm's marketing and firm performance (Table 1 and 2), using a multitude approach and various measures. Conventional wisdom is that a firm's tangible and intangible marketing assets are associated with higher stock prices, lower production costs, and greater innovative efficiencies. However, as RBV posits, a firm's input resources and output objectives are unique and difficult to internally grow or imitate. Merger can be a solution because it is a process whereby two organizations integrate into one entity to strengthen their competitive advantage by blending core assets. The first-stage analysis allows for a comparison of productivity changes in a firm's marketing, R&D, and operation functions pre- and post-merger.

The second-stage explores how productivity of a firm fosters value creation in a merger by testing the key links between productivity changes, and stock performance. It is important to

note that the dependent variable in the second-stage should be independent of the input-output variables used in the first-stage and, at the same time, the scale of operation. Because I use individual expenses and sales as input-output in the first-stage, usual accounting items and product market-related performance measures (e.g. net income and market share) that aggregate expenses and revenue are not appropriate to be used as a dependent variable in the second-stage. Because the primary interest of this study lies on firm value, I used stock return.[11] In addition to direct impacts, interactions between marketing, R&D, and operation productivity are examined because these three functions can serve as complements in enhancing firm value. Hence, above discussion and insights from the literature allow for a formulation of operation productivity as a function of:

Stock Performance = *f* (Marketing Productivity, R&D Productivity,
Operation Productivity, Marketing Productivity* R&D Productivity,
Marketing Productivity* Operation Productivity)

3.3 Data and Measures

Sample

The conceptual framework is based on the resource-based view of a firm's existing and newly acquired resources and the impacts of a combination of these resources on a firm's stock prices. This requires comprehensive data on an acquirer's current and past resources, outputs, and corresponding firm value. Therefore, data are drawn from several sources for the current study. The majority of the data are from the Securities Data Corporation (SDC) Thompson Merger and Acquisition database between 1990 and 2010. In addition, the COMPUSTAT of

[11] Possible alternatives are earnings per share and the market value of equity. However, earning per share is a noisy output because it is calculated based on net income. Because the marketing value of equity is affected by many factors, I use the abnormal stock returns as a dependent variable in the second-stage.

Standard & Poor's is used to collect acquirers' annual financial/accounting information including marketing investments, sales revenue, and other control variables. The Chicago Booth's Center for Research in Security Prices (CRSP) is used to collect stock market–related data to estimate short- and long-term stock returns. The final sample for the study consists of 153 public U.S. acquirers in chemical and rubbers (SIC codes 2800 through 3099) and electronic equipment and automotive (SIC codes 3600 through 3799) industry. The industries were chosen because they are characterized by intensive use of marketing assets relative to other functional actions, and, therefore, marketing-related issues serve as one of the fundamental motivations to merge. In these markets, incentives to salespersons, customer relations efforts, and trade incentives are of great importance. Because the primary interest of this study lies in the relations and changes between marketing investment, marketing productivity, and firm value during a merger, focusing on these markets provides an ideal research setting.

Measures

I focus on both short- and long-term financial market performance. First, I estimate annual stock return by compounding the monthly stock returns for a given fiscal year. Short-term performance uses 12 consecutive monthly stock returns starting from the January after a merger is announced. Long-term performance uses 24 (2-year) consecutive monthly stock returns.[12] *Marketing Output* is the dollar amount of a firm's sale, reduced by trade discounts and cash. *Operation Output* is the dollar amount of a firm's cost of goods sold. These proxies are chosen because the foremost goals of marketing and operation activities are to maximize sales revenue and minimize the production cost, respectively. *R&D Output* is the citation-weighted patent

[12] To control for the value risk (Fama and French 1993), I use the risk-adjusted abnormal stock return, However, the overall findings remain unchanged by the use of size-adjusted or equally weighted market portfolio (Mizik and Jacobson 2007; Mizik 2010).

count[13] to capture the innovativeness of R&D output by measuring the number of citations the patent has within and outside a firm's industry. The weight is calculated as the ratio between the number of citations a patent has and the average number of citations a firm has for all patents belonging to the firm. Table 9 presents the descriptive statistics for the study focal variables.

Table 9
Descriptive Statistics

	Mean	Median	STD
Advertising (million $)	134.32	112.68	188.62
SG&A (million $)	156.65	162.95	164.85
R&D (million $)	107.57	98.26	204.04
Cost of Goods Sold (million $)	166,324.76	204,123.83	5,204.51
Sales (million $)	22,379.59	27,158.57	6,485.52
Citation-Weighted Patent (annual)	47.97	49.21	200.09

Note: This table summarizes the descriptive statistics for measures of Advertising investment, Marketing investment, R&D investment, Cost of Goods Sold, Sales, and number of Citation-Weighted Patent for a sample of 153 U.S. public acquirers that completed a merger in chemical and rubbers (SIC codes 2800 through 3099) and electronic equipment and automotive (SIC codes 3600 through 3799) industry between 1986 and 2014.

Advertising Capital captures the carryover effects of advertising effort by estimating a Koyck-lag model. Advertising capital for a firm *i* at year *t* is calculated as $Advertising\ Capital_{it} = \sum_{k=1}^{t} \lambda^{t-k} * Advertising\ investment_{ik}$. The higher the value of λ, the greater the carryover effects of advertising expenditure from previous periods. *Marketing Capital* captures the carryover effects of marketing effort by estimating a Koyck-lag model. Marketing capital for a firm *i* at year *t* is calculated as $Marketing\ Capital_{it} = \sum_{k=1}^{t} \gamma^{t-k} * SG\&A\ investment_{ik}$. To avoid counting twice in the input vector, R&D expenditure is subtracted from Selling, General

[13] This measure requires exhaustive data collection. For example, Narasimhan et al. (2006) use more than 150,000 patents in their analysis of high-technology firms in semiconductor and computers industry. Similarly, I perform an extensive content analysis of over 45,000 patents obtained from the U.S. Patent Office between 1986 and 2014 to construct this variable. The data contains all patents for product/process innovation belonging to both merging parties (acquirers and target) as well as their competitors in order to estimate a firm's R&D productivity relative to its rivals. Similarly, a firm's sales, advertising investments, and SG&A investments are obtained from 1986 to 2014 in order to provide sufficient information to estimate the carry over effect.

and Administrative Expenses (SG&A). The higher the value of γ, the greater the carryover effects of marketing expenditure from previous periods. *R&D Capital* captures the carryover effects of R&D effort by estimating a Koyck-lag model. R&D capital for a firm *i* at year *t* is calculated as $R\&D\ Capital_{it} = \sum_{k=1}^{t} \delta^{t-k} * R\&D\ investment_{ik}$. The higher the value of δ, the greater the carryover effects of R&D expenditure from previous periods. To account for the impacts of an existing customer base, *Customer Base* is estimated by a Koyck-lag model. Customer base for a firm *i* at year *t* is calculated as $Customer\ Base_{\ it} = \sum_{k=1}^{t} \theta^{t-k} * SALES_{ik}$. The higher the value of θ, the greater the carryover effects of customer base from previous periods. *Labor Cost* is the average wage, measured by dividing the costs of employees' wages and benefits allocated to continuing operations by the number of employees. *Capital Cost* is investment as capital expenditure. Finally, *Patent Base* for a firm *i* at year *t* is calculated as $Number\ of\ Patent_{it}$.

3.4 Empirical Analysis and Results

Data Envelopment Analysis (DEA)

The approach followed in this study centers on the Data Envelopment Analysis (DEA), a technique rooted in microeconomic theory, which uses the optimization method. This mathematical programming technique measures the optimally weighted relative productivity in converting multiple inputs into multiple outputs of firms operating under similar conditions (Banker et al. 1984; Charnes et al. 1978). DEA has been widely used in studying efficiency among different branches of a bank (Kamakura et al. 2002), the efficiency focus of firms (Mittal et al. 2005), marketing communication credibility (Luo and Donthu 2006), and quantifying managerial ability (Demerjian et al. 2012). Efficiency of a firm is measured by comparing the inputs and outputs to those of the most efficient firm among those producing similar levels of

outputs in the industry. DEA identifies a set of efficient firms and creates a virtual production frontier as a convex combination of the firms. A set of efficient firms (or linear combinations of firms) operates at the maximum efficiency, given inputs. By calculating the distance of a firm under analysis from the virtual frontier, it provides a score of relative efficiency against the set of Pareto-efficient observations that can be practically achieved. Firms that are inefficient in their use of inputs score less than one while Pareto-efficient firms score closer to one. Thus, the DEA efficiency score can be considered the ratio of outputs over inputs and as an ordinal ranking of relative efficiency operating in the same industry.

The main advantage of the nonparametric DEA method is that it accommodates economies of scale by only evaluating firms operating at similar input levels, rather than comparing firms to all other observations. In doing so, and by incorporating the piecewise linear frontier, DEA integrates the nonlinearity in the relationship between inputs and outputs (Kamakura et al. 2002). Further, in focusing on revealed best practice among neighbors, this technique provides a basis for evaluating the optimality. The second advantage of DEA is that it calculates an efficiency score without imposing a prior explicit weighting structure. It does not require specification or knowledge of ad hoc weights or prices for both inputs and outputs. In a similar vein, it does not depend upon the functional form of a production relationship. Finally, the DEA produces a single aggregate measure of a firm's productive efficiency. Therefore, it is possible to estimate desired changes in inputs or outputs for projecting firms below the virtual frontier onto the curve. Comparing estimate results from parametric methods, which essentially estimate efficiency relative to industry average performance, provides insights into the causes and extent of inefficiency.

The measure of DEA implicitly emphasizes the allocative efficiency in the sense that all inputs contribute to the production and are subject to managerial discretion. Thus, this measure is unique in that it emphasizes the role of the manager. In theory, constant evaluation and benchmark processes are essential to improving firm performance. Such processes are widely used for identification and adoption of the best practices as a means of achieving and maintaining competitive advantage. Merger or acquisition is one of the examples of processes that firms engage in to maintain and increase competitive advantage. DEA procedure fits well with the current competitive market, as firms are seeking to strike the right balance between revenue expansion and efficiency improvement simultaneously (Anderson et al. 1997). DEA is an appropriate analysis technique as it offers a focus on cost efficiency (producing maximum outputs given the inputs) and an emphasis on the allocative efficiency (choosing an optimal set of inputs) among other features.

I apply a basic DEA procedure that is formulated as a fractional programming problem and then transformed to linear programming to obtain the values for virtual weights of inputs and outputs. For any firm θ, DEA solves:

$$\text{Max } \frac{\sum_j u_j y_{j\theta}}{\sum_i v_i x_{i\theta}} ,$$

$$\text{subject to } \frac{\sum_j u_j y_{j\theta}}{\sum_i v_i x_{i\theta}} \leq 1, \text{and } u_j, v_i \geq 0 \qquad (3)$$

where $x_{i\theta}$ is the value of input *i* for firm θ and $y_{j\theta}$ is the value of output *j* for firm θ. The objective is to obtain weights (v_i and u_j). Once optimal weights are derived, then the result yields a ratio scaled efficiency score for each firm θ, ranging from 0 to 1.

It is important to note that, as a benchmark, I also include firms in the same industry that are not involved in a merger activity in the given year. This enables me to identify the Pareto-

efficient unit and to compare it to a firm under analysis. Specifically, the analysis focuses on five "local" observations in terms of input scales, as a Pareto-efficient firm can be considered as a local maximum, having a similar amount of input. An acquisition achieves superior performance compared to its competitor in similar conditions, rather than guarantees a maximum output level or relative productivity on the market. This implies that benchmark samples do not consist of the same observations for the pre- and post-periods since the acquirers' input levels adjust after a merger by nature. More importantly, the Pareto-efficient firms are considered as "optimal" in the sense that they are achieving maximum efficiency given similar levels of multiple inputs. If a firm uses fewer resources compared to other firms without sacrificing its output after a merger, it is considered successful and effective. Otherwise, it is unsuccessful and an inefficient investment. Thus, successful acquirers represent the best-practice frontier that optimally reconfigures a firm's resources to produce goods. The improvement may be the result of benchmark processes that a merger or acquisition usually provide by absorbing capabilities from the target.

Measuring Marketing Productivity

Marketing productivity is estimated by the Cobb-Douglas functional form as follows:

$$\ln(Sales)_{it} = \beta_0^m + \beta_1^m * \ln(Adertising\ Capital)_{it} + \beta_2^m * \ln(Marketing\ Capital)_{it} + \beta_3^m * \ln(R\&D\ Capital)_{it} + \beta_4^m * \ln(Customer\ Base)_{it} + \eta_{it}^m - \varepsilon_{it}^m \quad (4)$$

where *i* stands for firm, *t* for time (year). The coefficient β_1^m measures the marginal productivity of advertising capital. This represents how sales changes as advertising capital changes. Similarly, the coefficients β_2^m through β_4^m are elasticities of corresponding independent variables. If sales exhibits diminishing marginal productivity, then these marginal productivity measures (β_1^m through β_4^m) are expected to have positive values. The η_{it}^m is a random error representing all

unobservable components of the dependent variable. Finally, the ε_{it}^{m} is of primary interest because it gauges the inefficiency in marketing of a firm *i* at time *t*.

Measuring R&D Productivity

R&D productivity is estimated by the Cobb-Douglas functional form as follows:

$$\ln(Citation-weighted\ Patent)_{it} = \beta_0^r + \beta_1^r * \ln(R\&D\ Capital)_{it} + \beta_2^r * \ln(Patent\ Base)_{it} + \beta_3^r * \ln(Marketing\ Productivity)_{it} + \eta_{it}^r - \varepsilon_{it}^r \quad (5)$$

where *i* stands for firm, *t* for time (year). The coefficient β_1^r measures the marginal productivity of R&D capital. This represents how the numbers of citation-weighted patents change as R&D capital changes. Similarly, the coefficients β_2^r and β_3^r are elasticities of corresponding independent variables. If the number of citation-weighted patents exhibit diminishing marginal productivity, then these marginal productivity measures (β_1^r through β_3^r) are expected to have positive values. The η_{it}^r is a random error representing all unobservable components of the dependent variable. Finally, the ε_{it}^r is of primary interest because it gauges the inefficiency in R&D of a firm.

Measuring Operation Productivity

Operation productivity is estimated by the Cobb-Douglas functional form as follows:

$$\ln(COGS)_{it} = \beta_0^o + \beta_1^o * \ln(Labor\ Cost)_{it} + \beta_2^o * \ln(Capital\ Cost)_{it} + \beta_3^o * \ln(R\&D\ Capital)_{it} + \beta_4^o * \ln(Marketing\ Productivity)_{it} + \eta_{it}^o - \varepsilon_{it}^o \quad (6)$$

where *i* stands for firm, *t* for time (year). The coefficient β_1^o measures the marginal productivity of labor cost. This represents how the cost of production changes as labor cost changes. Similarly,

the coefficients β_2^o through β_4^o are elasticities of corresponding independent variables. If cost exhibits diminishing marginal productivity, then these marginal productivity measures (β_1^o through β_4^o) are expected to have positive values. The η_{it}^o is a random error representing all unobservable components of the dependent variable. Finally, the ε_{it}^o is of primary interest because it gauges the inefficiency in operation of a firm.

Modeling the Relation between Functional Productivity and Firm Value

The relation among functional productivities and firm value is estimated as follows:

$$\begin{aligned} Stock\ Performance_{it} &= \beta_0^t + \beta_1^v * Stock\ Performance_{it-1} + \beta_2^v * Marketing\ Productivity_{it} \\ &+ \beta_3^v * R\&D\ Productivity_{it} + \beta_4^v * Operation\ Productivity_{it} \\ &+ \beta_5^v * Marketing\ Productivity_{it} * Operation\ Productivity_{it} + \beta_6^v \\ &* Marketing\ Productivity_{it} * R\&D\ Productivity_{it} + \varepsilon_{it}^v \end{aligned} \quad (7)$$

where *i* stands for firm, *t* for time (year). The model also controls for the *merger type* and *year* and *industry*. The coefficients β_2^v thorough β_4^v measure the impact of a firm's marketing, R&D, and operation productivity on firm stock performance. The coefficient β_5^v measures the interaction between a firm's marketing and operation productivity and the coefficient β_6^v measures the interaction between a firm's marketing and R&D productivity. Note that the coefficient β_1^v measures the persistence of stock prices. To account for the impact of the lagged dependent variable, I use a difference GMM estimator (Arellano and Bond 1991; Arellano and Bover 1995; Blundell and Bond 1998), which involves the first-differencing and the use of historical values of the endogenous variable as instruments. This analysis employs a two-stage (2SLS) approach similar to methods used in Chapter 2 in order to incorporate heterogeneity and endogeneity.

Results

Table 5 in Chapter 2 presents how marketing investments of an acquirer peak in a merger year compared to non-merger years. Similarly, Table 10 presents how an acquirer's investments in advertising, marketing, and R&D fluctuate for three years surrounding a merger announcement. The top panel of Table 10 shows the results using the size-adjusted investments and the bottom panel of Table 10 shows the results using the size- and industry-adjusted investments. The size-adjusted investment is the yearly investment in each functional area relative to total asset. The size- and industry-adjusted investment is calculated by subtracting the industry average of the size-adjusted investment for all firms operating in the same industry from the size-adjusted investment of a focal firm. Industries are identified using their two-digit SIC codes.

Table 10
Advertising, Marketing, and R&D Investments through a Merger

	(1)	(2)	(3)	Difference	
	year t-1	year t	year t+1	(2) - (1)	(3) - (2)
Size-Adjusted Values					
Advertising Investment	5.43%***	6.84%***	3.37%***	1.41%***	-3.47%***
Marketing Investment	5.32%***	6.94%***	3.10%***	1.62%***	-3.84%***
R&D Investment	5.35%***	6.94%***	4.94%***	1.59%***	-2.00%**
Size- and Industry-Adjusted Values					
Advertising Investment	3.44%***	-1.24%***	-5.51%***	-4.68%***	-4.27%***
Marketing Investment	1.56%***	-1.58%***	-4.65%***	-3.14%***	-3.07%**
R&D Investment	2.14%***	-1.87%***	-5.26%***	-4.01%***	-3.39%***

*** $p < .01$, ** $p < .05$, * $p < .10$
Note: This table summarizes an acquirer's investments in advertising, SG&A, and R&D respectively, for three years surrounding a merger announcement year. The size-adjusted investment is the yearly investment in each functional area relative to total asset. The size- and industry-adjusted investment is calculated by subtracting the industry average of the size-adjusted investment for all firms operating in the same industry from the size-adjusted investment of a focal firm. Industries are identified using two-digit SIC codes.

The results in the top panel show that acquirers significantly increase their investment in advertising, marketing, and R&D pre-merger (Column 5), while they significantly decrease in all three functional areas post-merger (Column 6). This is consistent with the findings presented in Chapter 2. However, the results of size- and industry-adjusted investment in the bottom panel of Table 10 indicate that, on average, chemical and rubbers, and electronic equipment and automotive acquirers significantly decrease their investments even in the merger year compared to a year prior a merger announcement (Column 5). These patterns contrast with results in the top panel of Table 10 and results that compare the unadjusted raw changes in advertising, marketing, and R&D investments, which are not reported here. In these untabulated results, raw changes in investments exhibit a monotonically increasing tendency over the years, from year *t-1* though year *t+1*. Taken together, the results suggest that acquirers appear to increase their investments in three functional areas at first glance, however, after controlling for firms' size and competition, acquirers tend to reduce their investments in a merger year and a year following a merger announcement.

Next, I apply the DEA model to a sample of 153 firms to estimate three functional frontiers, outlined in equations (4) through (6). The DEA provides a score of relative productivity, based on the ratio of outputs over inputs, against the set of Pareto-efficient observations that can be achieved in the same industry. Firms that are inefficient score less than one while Pareto-efficient firms score closer to one. The results provide the coefficients of input resources on its relevant output components as well as the measure of the three functional productivity scores. Table 11 summarizes the results from the DEA estimation of equations (4) through (6) for the entire sample pre- and post-merger.[14]

[14] The DEA estimation offers diagnostics to managers in terms of the level of inputs that are overused to produce each firm's current production. Accordingly, one can improve its production level by reassigning a fraction of the

Table 11

DEA Estimation Results: Parameter Estimates of Marketing, R&D, and Operation Productivity Pre- and Post-Merger

	(1) Pre-merger (year *t-1*)	(2) Post-merger (year *t+1*)	Difference (2) - (1) ((year *t+1*) – (year *t-1*))
Panel 1: Marketing Frontier (DV: Sale)			
Coefficient Estimate			
Advertising Capital	0.529***	0.578***	
Marketing Capital	0.736***	0.725***	
R&D Capital	0.439*	0.384*	
Customer Base	0.349*	0.352*	
Productivity Estimate			
Average Marketing Productivity Score	0.8462	0.8700	0.0208***
Panel 2: R&D Frontier (DV: Patent)			
Coefficient Estimate			
R&D Capital	0.725***	0.696***	
Patent Base	0.429**	0.430**	
Marketing Productivity	0.483**	0.515**	
Productivity Estimate			
Average R&D Productivity Score	0.7817	0.7901	0.0096
Panel 3: Operation Frontier (DV: COGS)			
Coefficient Estimate			
Labor Cost	0.442**	0.561**	
Capital Cost	0.489**	0.632***	
R&D Capital	0.310*	0.301*	
Marketing Productivity	0.294*	0.347*	
Productivity Estimate			
Average Operation Productivity Score	0.8225	0.7765	-0.0460***

*** $p < .01$, ** $p < .05$, * $p < .10$

Note: This table summarizes the results from the DEA estimation of marketing (Panel 1), R&D (Panel 2), and operation (Panel 3) frontier model (equations 4-6) for the entire sample pre- (year *t-1*) and post-merger (year *t+1*). The results provide the coefficients of input resource on its relevant output components as well as the estimates of the three functional productivity scores. Firms that are inefficient score less than one while Pareto-efficient firms score closer to one.

inputs currently utilized. A detailed discussion of the optimal resource allocation strategy would be beyond the scope of this study. Hence, the related results are not reported here. However, I discuss the implications of the results.

Marketing Productivity. Both marketing productivity estimates and maximum likelihood coefficient estimates of inputs are reported in Panel 1 of Table 11. The results show that firms have a higher marketing productivity in the year following a merger (0.8700) relative to in the year prior to a merger (0.8562). This finding suggests that firms use their marketing inputs better in post-merger. Note that the difference in means (0.0208) is statistically significant at the 1 percent level.[15] This suggests that if the objective of a merger is related to marketing productivity, then, on average, acquirers in the chemical and rubbers, and electronic equipment and automotive markets are significantly benefited from the merger. To the extent that productivity increase is the ultimate goal of the merger, acquirers reap significant productivity rewards via economies of scale. In addition, the average marketing productivity score is generally higher than the average score of R&D and operation productivity around a merger, which suggests that firms are operating relatively well in marketing compared to in the two functional areas.

Regarding the coefficient estimates, both advertising and marketing capital variables in Panel 1 have a significantly positive impact in both pre- and post-merger periods, implying that firms with greater investment in advertising and marketing can achieve a higher level of sales. R&D capital is marginally significant pre-merger and becomes insignificant post-merger. Finally, customer base has a moderate positive impact in both pre- and post-merger periods, at the 10 percent level. These findings are consistent with previous results in the marketing literature that show that in industries where innovation is less essential, firms need to focus more on market-oriented strategies, such as advertising, marketing, and customer relations efforts. Results from this study build on previous work by measuring how marketing assets relative to R&D assets impact a firm's sales in the chemical and rubbers, and electronic equipment and automotive

[15] I use Mann–Whitney U test following the DEA literature (Murthi et al. 1996). Mann–Whitney U test is a rank-based nonparametric test that can be used to determine if there are statistically significant differences between two or more groups of a continuous or ordinal variable.

markets. As discussed in the analysis section, the coefficient estimates in the log-log equation measure the marginal productivity, representing how sales change as a corresponding independent variable changes. For example, the coefficient estimate of advertising capital post-merger (0.578) indicates that a 1 percent increase in advertising capital increases sales by approximately 0.578 percent. Similarly, the elasticities of marketing capital post-merger is 0.725, suggesting that a 1 percent increase in marketing capital increases sales by approximately 0.725 percent.

R&D Productivity. Both R&D productivity estimates and maximum likelihood coefficient estimates of inputs are reported in Panel 2 of Table 11. Results show that firms have similar levels of R&D productivity in the pre- and post-merger year. Note that the difference in means (0.0096) is statistically insignificant at the 10 percent level. Coming to the coefficient estimates, both R&D capital and marketing productivity variables have a significantly positive impact in both pre- and post-merger periods, implying that firms with greater investment in R&D and marketing can achieve a higher level of sales. The number of patents has a moderate positive impact in both pre- and post-merger periods, at the 5 percent level. The coefficient estimate of R&D capital post-merger (0.696) indicates that a 1 percent increase in R&D capital increases sales by approximately 0.696 percent. Similarly, the elasticities of marketing productivity post-merger is 0.515, suggesting that a 1 percent increase in marketing productivity increases sales by approximately 0.515 percent. Note that the average R&D productivity score is generally lower than the productivity of other functional areas. This result has two potential explanations: either firms do not recognize that R&D productivity can be improved or they do not appreciate the effect of differentiation based on R&D assets. In either case, the results discussed above provide meaningful insights for managers.

Operation Productivity. Both operation productivity estimates and maximum likelihood coefficient estimates of inputs are reported in Panel 3 of Table 11. Results show that firms have lower operation productivity post-merger relative to pre-merger. This finding suggests that firms use their operation inputs better during the pre-merger year. Note that the difference in means (0.0460) is statistically significant at the 1 percent level. This result suggests that if the objective of a merger is related to operation productivity then, on average, acquirers are not significantly benefited from the merger. Acquirers have failed to reap significant productivity rewards from mergers via economies of scale. Regarding the coefficient estimates, both labor and capital cost variables have a significantly positive impact in both pre- and post-merger periods, implying that firms with greater investments in labor and capital can achieve higher levels of sales. Both R&D capital and marketing productivity have a moderate positive impact in both pre- and post-merger periods, at the 5 percent level. The coefficient estimate of labor cost post-merger (0.561) indicates that a 1 percent increase in labor cost increases sales by approximately 0.561 percent. Similarly, the elasticity of capital cost post-merger is 0.632, suggesting that a 1 percent increase in capital cost increases sales by approximately 0.632 percent.

Productivity and Firm Value. This study also focuses on how changes in productivity through a merger impact a firm's stock return. To test these relations, the stock return of a firm in year $t+1$ and year $t+2$ is separately regressed on changes in three functional productivity measures between year $t+1$ and year $t-1$. Interactions terms between three productivity measures are included to jointly test the effects and the lagged value of stock return is included to account for the persistence in stock prices. Table 12 presents the estimation results of the GMM estimation outlined in the previous section.

The results indicate that there is a significant negative impact of changes in marketing productivity on stock return (year *t+1*: -0.0259, year *t+2*: -0.0104), suggesting that increases in marketing productivity are associated with lower stock return. There is also a negative coefficient on the interaction term between marketing and R&D productivity, (year *t+1*: -0.0127), suggesting that the more positive the changes in marketing productivity in the post-merger period, the more negative the association between R&D productivity and firm value. These findings are important because they suggest that, even though decreasing marketing investment post-merger leads to a higher marketing productivity (as shown in Table 11), the disinvestment in marketing may result in lower stock prices. As predicted in microeconomics literature by the law of diminishing returns to scale, it is clear that productivity increases as the quantity of inputs used decreases. The increase in productivity post-merger may demonstrate the usefulness of a disinvestment, however, firms that reduce their marketing investment may face a loss of stock returns. Specifically, the empirical results show a negative association between the productivity increase and firm value. This juxtaposition could lead to difficult decisions for the marketing manager. In sum, superior marketing investment is more likely to lower the level of marketing productivity, but this low productivity tends to achieve higher stock prices. To illustrate, I use the same example discussed in the previous marketing frontier section. A randomly chosen firm's sales increase approximately by 1 percent as a result of a 10 percent increase in a marketing investment post-merger. A further analysis based on the same example suggests that the increase in marketing investment leads to approximately a 0.66 percent reduction in marketing productivity score (from 0.8948 to 0.8889), and approximately a 3.03 percent increase in stock return (from 0.0132 to 0.0136). As was previously noted, this example is essentially explanatory in nature. The total effect of resource re-allocation only can be computed individually, depending

on the assumption employed for the estimation as well as on several firm- and industry-specific factors.

Table 12
GMM Estimation Results: Parameter Estimates of the Relation between Firm Value and Marketing, R&D, and Operation Productivity

	Stock Return Year *t+1*	Stock Return Year *t+2*
Δ Marketing Productivity Score	-0.0259**	-0.0104*
Δ R&D Productivity Score	0.0198**	0.0052
Δ Operation Productivity Score	0.0472***	0.0332***
Δ Marketing * Operation Productivity Score	0.0561***	0.0271**
Δ Marketing * R&D Productivity Score	-0.0127*	-0.0083
Δ Lagged Stock Return	0.0328**	0.0223**

*** $p < .01$, ** $p < .05$, * $p < .10$
Note: This table summarizes the results from the GMM estimation of the relation between firm value and marketing, R&D, and operation productivity (equation 7) for the entire sample. The results provide the estimates of the impacts each independent variable has on stock return through a merger. The dependent variable is the stock return of a firm in year *t+1* and year *t+2*. Stock Return Year *t+1* uses 12 consecutive monthly stock returns starting from the January after a merger is announced. Stock Return Year *t+2* uses 24 consecutive monthly stock returns. The independent variables are changes in three functional productivity measures between year *t+1* and year *t-1*, their interaction terms, and the lagged stock return. All the serial correlation and instrument validity tests support the use of GMM model proposed.

Theoretical valuation for the negative association between marketing productivity and firm value is that the financial markets selectively perceive information contained in marketing investment about the future marketing productivity, and resultant, future firm value. Investors, acknowledging the law of diminishing returns, may place less weight on the potential changes in productivity because they believe that productivity reduction is inevitable during the merger process and, as such, productivity adjustment may be less indicative of future prospects. As discussed in Chapter 2, investors view an increase in marketing investment as a credible tool managers can use in order to reduce the degree of information asymmetry and to maintain competitive advantage, especially in the post-merger period.

The financial market's tendency to selectively incorporate information appears isolated from the marketing investment. The results of Table 12 present a positive and statistically significant effect of operation productivity score (year *t+1*: 0.0472, year *t+2*: 0.0332), suggesting that investors do not react favorably to the reduction in operation productivity shown in Table 11. Furthermore, looking at the interaction term with marketing productivity (year *t+1*: 0.0561, year *t+2*: 0.0271), the positive impact of improvements in operations dominates, despite the negative main effect of marketing productivity score. These results suggest that the most significant determinant of firm value in a merger is the interaction of marketing and operation productivity. This is also in accordance with findings from the marketing literature that firms in relatively stable-technology market need to excel at two functional areas: a firm's capability to exploit the benefits by meeting customers' need and preference, and a firm's capability to produce products with minimum costs. The results presented here support the view that highlights the importance of marketing and operation functions in the chemical and rubbers, and electronic equipment and automotive industries. In addition, results show a significant persistence in stock prices (year *t+1*: 0.0328, year *t+2*: 0.0223), as expected. These results echo what is found in the marketing literature.

3.5 Conclusion

Discussion

The current study explores the links between an acquirer's marketing investment, marketing productivity, and financial market value in the chemical and rubbers, and electronic equipment and automotive markets, where mergers are expected to change the whole outlook of an acquirer and its industry. Cobb-Douglas production function, DEA productivity indices, and GMM estimation techniques are used to generate inferences. The results show that acquirers, on

average, decrease their marketing investment post-merger; however, at the same time, increases in marketing are associated with increases in sales. Increased focus on marketing, in some cases, would result in a drop in marketing productivity, which positively affects investors' expectation in the stock market. The results show that increases in marketing investments are associated with higher stock returns. This suggests that the investors are appreciative of the signalling role of increased marketing investment. The investors view firms who spend more on marketing post-merger as having greater future cash inflow and growth opportunity. These results underscore the importance of marketing in ensuring success not only in the product market but also in the financial market.

Theoretical Implications

Several different measures have been utilized to estimate an agent's productivity. A common method is to calibrate an indirect estimate using survey approach. I investigate the relations among investment, productivity, and firm value by employing the DEA model as a platform to obtain measures of productivity in relation to that of rivals in the same industry. Estimating a construct such as productivity is difficult because any set of methods is unlikely to manifest the elements completely. To address this issue, I assess the productivity in three different functional areas areas—marketing, R&D, and operation—and utilize several different sets of input resources and output variables. In addition, I use the GMM modelling in order to control for heterogeneity and endogeneity simultaneously. A clear benefit of controlling for heterogeneity and endogeneity is the estimation of unbiased coefficients from the model. Using the Cobb-Douglas production function, DEA productivity indices, and GMM estimation techniques, I quantify the effects of marketing investment and productivity on firm value.

Managerial Implications

I provide several managerial guidelines. First, the DEA approach demonstrates a comprehensive analysis that can offer strategic directions to managers in allocating their limited resources post-merger. The analysis reported simultaneously investigates all of the critical relations between inputs, outputs, and stock returns. Depending on the individual acquirer's business environment, managers may make decisions in terms of marketing investment to increase sales and stock prices, believing that marketing assets will have a significantly positive impact on firm performance. In a review of a randomly chosen firm described in previous sections, a hypothetical increase in marketing investment leads to a ~1 percent increase in sales and a ~3.03 percent increase in stock return. This input-output relation that the DEA model explicitly focuses on provides specific implementation guidance to managers. Adopting an approach that focused either on input-minimization or output-maximization may be an extra reason why some acquirers in the sample are classified as inefficient relative to close rivals. In the post-merger period, seeking to strike the right balance between revenue expansion and efficiency improvement simultaneously becomes more important. Next, the results may provide managers with justification for marketing investment. Investors in the financial market place a significant positive weight on a firm's marketing strategy. However, many firms appear to not emphasize the implications of marketing, presumably due to the difficulty of measuring the returns from marketing investments. Results from the current study show that in some cases, firms may be inefficient in distributing input resources because they may have been consistently underinvesting in marketing or other functional areas. Firms that fail to allocate sufficient key input resources to produce key outputs cannot be expected to outperform their rivals in the market.

Limitations

This study has several limitations. First, the data are collected from one point in time. It would be preferable to test long-terms effects and productivity changes by using multi-period data. Such investigation is needed to study overall impacts surrounding the relation between investment, productivity, and firm value. Similarly, adopting alternative measures for firm value such as customer satisfaction is a natural research avenue. Furthermore, addressing other industries where R&D assets are of special interest (e.g., computers and electronics) would be worthwhile. The DEA approach also has limitations. There may be measurement error in the inputs and outputs as accounting information available contains measurement error. The DEA estimates are imperfect in that the specification and the choice of input and output variables can be subjective. Future research should refine variables in analysing effects.

CHAPTER 4 – ESSAY 3: STOCK MARKET REACTION TO MERGER ANNOUNCEMENT AND MARKETING INVESTMENTS POST-MERGER

4.1 Introduction

In the previous chapters, I explore the links between marketing investment, marketing productivity, and a firm's financial value. The results show that increasing marketing investment is more likely to lower the level of marketing productivity, but this low productivity tends to achieve higher stock prices. This juxtaposition could lead to difficult decisions for the marketing manager. However, mergers often lead to acquirers' disinvestment in their marketing post-merger relative to a firm's rivals. The situation prompts following questions: *Do the firms ignore the consequences of spending less in marketing post-merger?* W*hat factors drive post-merger marketing investment decisions?*

Researchers have documented a significant correlation between corporate investment decisions and stock prices (Mizik and Jacobson 2007; Chakravarty and Grewal 2011; Mizik 2010). The underlying rationale is that the past behavior of a firm's stock creates investors' expectations and affects managers' decisions. Specifically, the stock returns and volatility signal managers about the quality of their decisions, especially when investors believe these managerial decisions are poor. As a result, managers use the information contained in a firm's stock movements when making investment decisions. Accordingly, the objective of the current chapter is to empirically examine the relationship between corporate investment decisions and stock prices in a merger context. I explore whether the acquirers' post-merger investment decisions are indeed influenced by the stock returns and stock volatility at the time of merger announcements.

To do this, I require a measure of the post-merger investment decision and a measure of the stock market reaction to a merger announcement. In order to comprehend the post-merger investment decision, I categorize acquirers into four groups based on the pattern of marketing and R&D investments. Firms are grouped depending on whether they spend more or less than the industry average in marketing and R&D. In order to estimate the stock market reaction, I use both stock returns and stock volatility at the time of a merger announcement (Mizik and Jacobson 2007; Chakravarty and Grewal 2011). The merger announcement return is calculated as the market-adjusted, three-day (-1, +1) cumulative abnormal return (CAR) around a merger announcement. The stock volatility is measured as the standard deviation of the merger announcement return. I collect the sample from the Securities Data Corporation's U.S. M&A database (SDC). I identify mergers and acquisitions announced between 1990 and 2010 that meet several criteria: 1) both the acquirer and the target are U.S. public companies, 2) the acquirer has annual financial statement information available from COMPUSTAT of Standard & Poor's and stock returns data from the Chicago Booth's Center for Research in Security Prices (CRSP), 3) the acquisition is completed, and 4) the acquirer obtains 100 percent of the target. Merging the SDC M&A, COMPUSTAT, and CRSP data samples yields an unbalanced pooled cross-sectional time series panel with a total of 2,514 observations.

I find that both merger announcement return and its volatility predict an acquirer's post-merger investment patterns. Acquirers extract information from the financial market reaction and consider it when making corporate investment decisions. I show that a negative reaction to a merger announcement leads to a superior investment in marketing relative to rivals and inferior investment in R&D post-merger. In addition, the results show that the relationship varies with the volatility of merger announcement return, suggesting that firms have a stronger incentive to

use information contained in the stock fluctuation as the degree of information is higher. The results are consistent with the contingent role of information asymmetry found in Chapters 2 and 3.

4.2 Conceptual Framework

Why Do Acquirers React to the Stock Market Reaction?

In this study, I empirically assess whether the stock returns and stock volatility drive managerial investment decisions post-merger. I do so by examining the links between a merger announcement return and its standard deviation, and patterns of post-merger marketing and R&D investments. Thus, I test whether information flows from the financial market to the acquiring firm manager and whether managers extract information from the investors' reaction to a merger announcement. The hypothesis implies that the stock market possesses information that is new to firms and helps managers improve their investments in marketing and R&D. Although managers are generally better informed than investors about the fundamental and prospects of a firm, I argue that, at the time of a merger announcement, the financial market has more information that managers do not know (Luo 2005; Chen et al. 2007). When a merger is announced, investors may not agree with the proposed merger because they believe that the total value of 1 combined entity will be reduced. This information is more likely to be related to a weakness of the merger plan the acquirer has overlooked, such as the potential competition following a post-merger integration or the potential demand shift for the merged firm's products or services. In addition, often only a group of top managers are involved in a merger decision. In this environment, institutional investors and analysts can be better positioned to understand the entire outlook of a

firm and its industry, while considering relevant micro- and macroeconomic factors.[16] Hence, the transmission of information from the financial market to managers is expected to occur at the time of a merger announcement, which, in turn, influences an acquirer's post-merger investment patterns.

Related Studies and Contribution

This study relates to the literature in marketing and finance that explores a correlation between stock market reactions and corporate investments. In marketing, studies have shown that firms react to past stock returns and volatility in the form of unexpected adjustments in marketing and R&D (Mizik and Jacobson 2007; Chakravarty and Grewal 2011; Mizik 2010). However, the evidence has shown mixed results regarding whether the unanticipated change in investments is a consequence of positive or negative financial market performance. For example, Chakravarty and Grewal (2011) find that firms increase their marketing investments to maintain or further increase their positive stock returns and volatility. On the other hand, Mizik and Jacobson (2007) find that managers have "myopic" incentives to cut their investments in an effort to meet investors' short-term expectations. Prior research has been unable to provide an unambiguous explanation because there are incentives promoting both "increase" and "decrease" investment in order to enhance firm value. This study contributes to the literature by focusing on the competitive nature of marketing and R&D investments. As previously shown in Chapters 2 and 3, when budgeting an acquirer's marketing and R&D, considering the competition plays a critical role in enhancing firm value post-merger. Superior marketing investment relative to rivals is more likely to achieve higher stock prices, although spending more tends to lower the

[16] This may explain why a number of mergers or acquisitions experience poor performance post-merger (Sorescu et al. 2007; Swaminathan et al. 2008). More than half of the acquirers in my sample exhibit negative announcement returns.

level of marketing productivity. On the managerial level, a merger time period is one of the most difficult situation to determine the level of marketing and R&D investments (Sorescu et al. 2007; Swaminathan et al. 2008). Because a merger combines two firms into one entity neither managers nor investors know what to expect in terms of the magnitude of corporate investment adjustments post-merger. This difficulty leads to a situation in which an acquirer's willingness to spend more or less relative to rivals becomes a more effective signal as a response to stock market reactions.

In the broader literature in finance, studies have shown that managers "learn" from the stock market and "use" this information when making investment decisions (Durnev et al. 2004; Luo 2005; Chen et al. 2007). The underlying rationale is that one of the fundamental roles of the financial market is to produce and aggregate of information, and this information is transmitted to managers via the trading process. Then this transmitted information can guide managers to make decisions in corporate investment. The investors can have an impact on the real economy through this mechanism, especially when they have no communication channels with managers. Durnev et al. (2004) and Chen et al. (2007) study the informativeness of stock returns by measuring stock price co-movements between a focal firm and the industry as a whole and by measuring the probability of informed trading based on the daily buy-and-sell orders. In addition, two studies have investigated the hypotheses related to this study in a merger context (Jennings and Mazzeo 1991; Luo 2005). While Jennings and Mazzeo (1991) do not find a significant relation, Luo (2005) shows the positive correlation between the acquirer's stock returns around the merger announcement and the completion of mergers. In contrast, I study the post-merger corporate investment pattern in marketing and R&D, rather than the acquirer's merger closing decision. I also study both stock returns and stock volatility around a merger announcement. The

examination of both stock returns and stock volatility allows for inferences to be drawn about whether and how the evaluation of investors about the proposed merger deal and the degree of information asymmetry in the stock market affect managerial investment decisions.

I believe above conceptual arguments justify the test of stock returns and volatility around a merger as a driver of the post-merger investment decisions. However, existing research (Mizik and Jacobson 2007; Chakravarty and Grewal 2011; Mizik 2010) suggests that there are incentives working to promote both directions—spending "more" or "less" relative to rivals in marketing and R&D post-merger—as a response to the financial market reaction. Therefore, while I investigate the relationship based on the indirect empirical evidence and theoretical conjecture the previous studies provide, it remains a matter of empirical investigation to determine the sign and magnitude of the effects.

4.3 Empirical Analysis and Results

Empirical Analysis

To test the potential reaction of firms to the stock market, I build on a regression of the post-merger investment decision on the stock returns and stock volatility at the time of a merger announcement. I use the following probit model:

$$Spending\ More_{it+1} = \beta_0 + \beta_1 * NAnnRet_{it} + \beta_2 * AnnVol_{it} + \beta_3 * NAnnRet_{it} * AnnVol_{it} + \beta_4 * Control_{it} + \varepsilon_{it} \quad (8)$$

where *i* stands for firm, *t* for time (year). The dependent variable, $Spending\ More_{it+1}$, is a dummy variable equal to 1 if the acquirer spends more than the industry average in which a firm operates and 0 otherwise. I use two different measures for the dependent variable: $Marketing_{it+1}$, measured as an acquirer's advertising expenditure scaled by total assets in the

year following a merger announcement; and $R\&D_{it+1}$, measured as a firm's R&D expenditure scaled by total assets in the year following a merger announcement. Industries are identified using two-digit SIC codes. *NAnnRet* is a dummy equal to 1 if the merger announcement return is negative and 0 otherwise. The merger announcement return is calculated as the market-adjusted, three-day (-1, +1) cumulative abnormal returns (CAR) around a merger announcement. The CRSP value-weighted index is used as a proxy for the market portfolio. A negative announcement return serves as a proxy for the pressure faced by managers because a negative reaction reveals that investors disagree with the proposed merger. *AnnVol* is measured as the standard deviation of the market-adjusted, three-day (-1, +1) cumulative abnormal returns (CAR) around a merger announcement. A volatile reaction in the financial market at the time of merger announcement suggests that the degree of information asymmetry is higher for the merger. *Control* consists of a vector of the merger- and firm-specific characteristics that are expected to co-vary with the acquirers' investment decisions: *merger type, cashpmt, lagged sales, lagged ROA, lagged investment in marketing and R&D, lagged stock returns and stock volatility, financial flexibility, size, book-to-market ratio, market share, industry,* and *year*. All control variables are defined as illustrated in Chapters 2 and 3. In equation (8), β_1, β_2, and β_3 are the primary interests.

Sample

I collect the sample from the Securities Data Corporation's U.S. M&A database (SDC). I identify mergers and acquisitions announced between 1990 and 2010 that meet several criteria: 1) both the acquirer and the target are U.S. public companies, 2) the acquirer has annual financial statement information available from COMPUSTAT of Standard & Poor's and stock returns data from the Chicago Booth's Center for Research in Security Prices (CRSP), 3) the acquisition is

completed, and 4) the acquirer obtains 100 percent of the target. The data treatment and merging procedure closely parallel those in the prior literature.[17] Merging the SDC M&A, COMPUSTAT, and CRSP data samples yield an unbalanced pooled cross-sectional time series panel with a total of 2,514 observations.

Results

Table 13 summarizes the market reaction to the merger announcements. The market-adjusted, three-day (-1, +1) cumulative abnormal returns (CAR) of both merging firms (the acquirer and target) around a merger announcement are presented. The Combined announcement CAR is the value-weighted average of the acquirer's and the target's announcement CARs. More than half of the mergers exhibit stock returns loss at the time of merger announcement. The Combined announcement CAR is negative in 56.42 percent of the sample. Only 18.34 percent of the targets have negative announcement returns while 60.72 percent of the acquirers have positive announcement returns. The acquirer returns dominate the combined returns because the acquirers are usually larger than the target firms.

Table 13
Descriptive Statistics of the Merger Announcement Returns

	Mean	SD	Frequency < 0	Correlation with	
				(2) Acquirer's Ann. CAR	(3) Target's Ann. CAR
(1) Combined announcement CAR	-0.76%	9.81%	56.42%	0.89	0.49
(2) Acquirer's announcement CAR	-2.34%	10.02%	60.72%		0.23
(3) Target's announcement CAR	18.96%	31.68%	18.34%		

Note: This table summarizes the market reaction to the merger announcements. The market-adjusted, three-day (-1, +1) cumulative abnormal returns (CAR) of both merging firms (acquirer and target) around a merger announcement are presented separately and combined. The *Combined announcement CAR* is the value-weighted average of the acquirer's and the target's announcement CARs.

[17] I retain only the biggest transaction in terms of deal value to eliminate the confounding effects of sequential mergers. In addition, the final sample is limited to mergers with deal value greater than $10 million. The final sample consists of mergers across all industries to preserve reliable and generalizable results. The result is not sensitive to the inclusion of the financial sector.

Table 14 describes the relationship between the stock market reaction around a merger announcement, both the combined announcement CAR (column 2) and its volatility (column 5), and the post-merger marketing and R&D investment patterns. In addition, this table shows the frequency of investment patterns among firms with negative (column 3) and positive (column 4) combined announcement CAR. The results show that the merger announcement returns predict the post-merger investment patterns. The average combined announcement return for acquirers spending less relative to rivals in both marketing and R&D is significant and negative (-1.52%). The mean combined announcement return is also significantly negative (-1.77%) for acquirers spending less in marketing but more in R&D. The mean announcement returns for other two groups of acquirers with different investment patterns are statistically insignificant (0.43 and 0.08%). The results suggest that companies spend less in marketing more often when the merger announcement return is negative. Furthermore, when the merger announcement return is negative, approximately 81 percent of acquirers (37+43%) spend less in R&D and 53 percent (37+16%) spend less in marketing. Of the sample acquirers, 37 percent spend less in marketing and R&D simultaneously. This shows that a significant proportion of firms appear to be spending less in either marketing or R&D, or both, as a response to negative stock market reaction. Finally, the average stock volatility (*AnnVol*) is generally higher for acquirers spending more in marketing (10.70 and 11.53%) than for acquirers spending less in marketing (7.49 and 8.78%). The differences are statistically significant at the 5-percent level. The results imply that companies spend more in marketing relative to rivals when there is a higher degree of information asymmetry at the time of a merger announcement. The results are consistent with the notion that managers extract information contained in stock movements and consider it when making forward-looking investment decisions.

Table 14
Reaction to the Merger Announcement and Post-Merger Investment patterns

	Mean Combined Ann. CAR (t-statistics)	Among Firms with NEGATIVE Combined Ann. CAR	Among Firms with POSITIVE Combined Ann. CAR	Mean AnnVol (t-statistics)
Spending LESS relative to rivals in both Marketing and R&D	-1.52% (-2.173)	37%	11%	7.49%
Spending LESS in Marketing but MORE in R&D	0.43% (-1.326)	16%	17%	8.78%
Spending MORE in Marketing but LESS in R&D	-1.77% (-2.218)	43%	19%	10.70%
Spending MORE relative to rivals in both MKT and R&D	0.08% (-0.982)	4%	52%	11.53%

Note: This table summarizes the relation between the stock market reaction around a merger announcement, both the combined announcement CAR (column 2) and its volatility (column 5), and the post-merger marketing and R&D investment patterns. In addition, this table shows the frequency of investment patterns among firms with negative (column 3) and positive (column 4) combined announcement CAR. *Combined announcement CAR* is the value-weighted average of the acquirer's and the target's announcement CAR's. *AnnVol* is the standard deviation of the *Combined announcement CAR*. The CRSP value-weighted index is used as a proxy for the market portfolio.

Table 15 presents the probit regression estimation results of the post-merger marketing and R&D investment patterns on the stock returns and stock volatility. The dependent variable for columns (1) and (2) is a dummy variable equal to 1 if the acquirer spends more in marketing than the industry average in which a firm operates and 0 otherwise. The dependent variable for columns (3) and (4) is a dummy variable equal to 1 if the acquirer spends more in R&D relative to rivals and 0 otherwise. *NAnnRet* is a dummy equal to 1 if the combined merger announcement CAR is negative and 0 otherwise. *Acquirer's NAnnRet* (*Target's NAnnRet*) is a dummy equal to 1 if the acquirer's (target's) merger announcement CAR is negative and 0 otherwise. I use the *NAnnRet* as an independent variable in columns (1) and (3) and both the *Acquirer's NAnnRet* and *Target's NAnnRet* in columns (2) and (4). *AnnVol* is the standard deviation of *NAnnRet* in columns (1) and (3) and the standard deviation of *Acquirer's NAnnRet* in columns (2) and (4). *NAnnRet*, *Acquirer's NAnnRet*, *Target's NAnnRet*, and *AnnVol* represent the financial market

reaction. Consistent with the previous univariate tests, the financial market reaction predicts the patterns of marketing and R&D investments.

Table 15
Probit Regression Estimation Results: Post-Merger Marketing and R&D Investment Patterns on the Stock Return and Stock Volatility

	Dependent Variable			
	Spending MORE in Marketing		Spending MORE in R&D	
	(1)	(2)	(3)	(4)
NAnnRet (Negative Announcement Return)	1.150**		-0.545*	
	(0.460)		(0.321)	
Acquirer's NAnnRet		1.151*		-0.514**
		(0.609)		(0.057)
Target's NAnnRet		-0.003		-0.004
		(0.816)		(0.747)
AnnVol (Announcement Volatility)	2.041***	2.375***	-0.357	-0.119
	(0.001)	(0.000)	(0.252)	(0.632)
NAnnRet* AnnVol	4.286***		-1.351***	
	(0.806)		(0.005)	
Acquirer's NAnnRet * AnnVol		3.902***		-1.022***
		(0.616)		(0.027)
Target's NAnnRet * AnnVol		-0.259		-0.196
		(0.209)		(0.390)

*** $p < .01$, ** $p < .05$, * $p < .10$
Note: This table summarizes the probit regresstion estimation results of the post-merger marketing and R&D investment patterns on the stock returns and stock volatility. The dependent variable for columns (1) and (2) is a dummy variable equal to 1 if the acquirer spends less in marketing than the industry average in which a firm operates and 0 otherwise. The dependent variable for columns (3) and (4) is a dummy variable equal to 1 if the acquirer spends less in R&D relative to rivals and 0 otherwise. *NAnnRet* is a dummy equal to 1 if the combined merger announcement CAR is negative and 0 otherwise. *Acquirer's NAnnRet* (*Target's NAnnRet*) is a dummy equal to 1 if the acquirer's (target's) merger announcement CAR is negative and 0 otherwise. I use the *NAnnRet* as an independent variable in columns (1) and (3) and both the *Acquirer's NAnnRet* and *Target's NAnnRet* in columns (2) and (4). *AnnVol* is the standard deviation of *NAnnRet* in columns (1) and (3) and the standard deviation of *Acquirer's NAnnRet* in columns (2) and (4).

Interpretation of the coefficients in probit regression is not as straightforward as the interpretations of coefficients in linear regression. The increase in probability attributed to a one-unit increase in a given predictor is dependent on both the values of the other predictors and the starting value of the given predictors. However, there are limited ways in which one can interpret

the individual regression coefficients. A positive (negative) coefficient means that an increase in the predictor leads to an increase (decrease) in the predicted probability. For example, the coefficient of *NAnnRet* in column (1) is 1.150 ($p < 0.05$), suggesting that the negative stock returns at the time of a merger announcement increases the probability of spending more in marketing relative to rivals post-merger. The coefficient of *NAnnRet* in column (3) is -0.545 ($p < 0.10$), suggesting that the negative merger announcement return decreases the probability of spending more in R&D post-merger. Taken together, the results suggest that a negative investors' reaction to a merger proposal is more likely to associate with a superior marketing investment and an inferior R&D investment post-merger. This is contrast with Chakravarty and Grewal (2011), who find that an increase in stock returns leads to an unanticipated increase in marketing and an unanticipated decrease in R&D simultaneously. Table 15 also shows that an increase in stock volatility (*AnnVol*) increases the probability of spending more in marketing (column (1): 2.041 and column (2): 2.375). Furthermore, the positive coefficient of the interaction between *NAnnRet* and *AnnVol* (4.286) suggests that the negative reaction from the stock market further increases the probability of spending more in marketing, when a higher degree of information asymmetry exists. These results echo what is found in Chapters 2 and 3 in that managers view marketing investment as an effective tool to deliver positive signal to investors. When investors express their opposition to the proposed merger deal via unfavorable announcement returns, managers seek to prove that the merger transaction is, in fact, value-enhancing through aggressive marketing strategy. Finally, the interaction of *NAnnRet* and *AnnVol* (column (3): -1.351) has a significant and negative impact, despite the insignificant main effect of *AnnVol* (column (3): -0.357). The results suggests that the higher stock volatility drives managers to

further cut their R&D investments as a response to a negative investors' reaction to a merger announcement.[18]

4.4 Conclusion

Discussion

The objective of this study is to examine the factors that drive an acquirer's marketing and R&D investment decisions in a merger context. I empirically examine the relationship between stock returns and stock volatility, and the post-merger corporate investment patterns. I explore whether an acquirer's post-merger investment decisions to spend more or less than their industry rivals are indeed influenced by the stock market reaction at the time of merger announcement. I find that both merger announcement return and its volatility predict an acquirer's post-merger investment patterns. Acquirers extract information from the financial market reaction and consider it when making corporate investment decisions. By using a probit regression, I show that a negative reaction to a merger announcement leads to a superior investment in marketing relative to rivals and inferior investment in R&D post-merger. In addition, the results show that the relationship varies with the volatility of merger announcement return, suggesting that firms have a stronger incentive to use information contained in the stock movements when the degree of information is higher. The results are consistent with the contingent role of information asymmetry found in Chapters 2 and 3.

Limitations

This study has several limitations. First, the data used in this study are collected on an annual basis. It would be preferable to test shorter-term effects by using quarterly data. Next, the

[18] The overall results remain the same with the use of *Acquirer's NAnnRet* but not with *Target's NAnnRet*, suggesting that the combined merger announcement return and stock volatility are better determinants of the acquirers' post-merger investment patterns than the individual firm measures.

use of advertising expenditure as a proxy is limited. Although I believe advertising captures a more relevant facet of marketing in a merger context (McAlister et al. 2007), it would be worthwhile to examine the importance of marketing in several directions. Furthermore, addressing other contexts (e.g., equity issuing events or product recalls) would be worthwhile (Mizik and Jacobson 2007; Gao et al. 2015). Finally, investigating the possibility of trade-offs in marketing and R&D investment and its impact on firm performance would be an interesting avenue to pursue (Chakravarty and Grewal 2011).

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